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ECONOMIC ANALYSIS OF EFFLUENT GUIDELINES FOR THE ASBESTOS INDUSTRY

ARTHUR D. LITTLE, INCORPORATED

PREPARED FOR
ENVIRONMENTAL PROTECTION AGENCY

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An analysis was made of the potential economic impact on the asbestos products manufacturing industry due to the implementation of the effleunt limitations standards formulated in compliance with the 1972 Federal Water Pollution Control Act Amendments.

The capital costs of meeting the "Best Practicable Technology" and "Best Available Technology" provisions of the standards are estimated to be $2.9 million and $6.5 million respectively. Annualized effluent treatment costs are respectively $1.4 million and $2.9 million. The industry is not expected to suffer major adverse impacts (under both standards) as measured by loss of production, unfavorable price structure, employment curtailment, etc.

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Asbestos-cement pipe; Asbestos-cement sheet; Asbestos floor tile; Asbestos millboard; Asbestos paper; Asbestos roofing; Asbestos Industry; Best Available Control Technology; Best Practicable Control Technology; Economic Impact Analysis; Effluent Limitation Guidelines.

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PREFACE

The attached document is a contractor's study prepared with the supervision and review of the Office of Planning and Evaluation of the U.S. Environmental Protection Agency (EPA). Its purpose is to provide a basis for evaluating the potential economic impact of effluent limitations guidelines and standards of performance established by EPA pursuant to sections 304(b) and 306 of the Federal Water Pollution Control Act.

The study supplements an EPA technical "Development Document" issued in conjunction with the promulgation of guidelines and standards for point sources within this industry category. The Development Document surveys existing and potential waste treatment and control methods and technologies within this category and presents the investment and operating costs associated with various control technologies. This study supplements that analysis by estimating the broader economic effects (including product price increases, continued viability of affected plants, employment, industry growth and foreign trade) of the required application of certain of these control technologies.

This study has been submitted in fulfillment of Contract No. 68-01-1541, Task No. 4 by Arthur D. Little, Inc. Work was completed as of November 15, 1974. The study is based primarily upon an earlier study, also prepared by Arthur D. Little, Inc. entitled "Economic Analysis of Proposed Effluent Guidelines for The Asbestos Products Manufacturing Industry." The earlier report was circulated in conjunction with the publication in the Federal Register of a notice of proposed rulemaking under sections 304(b) and 306 for the subject point source category. The analysis contained in the original study has been updated based upon information received during the period of time between publication of the notice of proposed rulemaking and the promulgation of the final regulation. Because of the constraints of time, the control and treatment costs analyzed in this study may not in all instances be identical to those associated with the requirements of the promulgated regulation. However, those differences, when they exist are minor insofar as the final conclusions of the study are concerned.

This report represents the conclusions of the contractor. It has been reviewed by the Office of Planning and Evaluation and approved for publication. Approval does not signify that the contents necessarily reflect the views of the Environmental Protection Agency. The study has been considered, together with the Development Document, information received in the form of public comments on the proposed regulation, and other materials in the establishment of final effluent limitations guidelines and standards of performance.

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EXECUTIVE SUMMARY

This report represents an assessment of the probable economic impact on the asbestos industry resulting from promulgation of the applicable effluent limitations guidelines for these sources published by the Environmental Protection Agency (EPA) in the Federal Register of Tuesday, February 26, 1974. The specific industry sub-categories of interest are asbestos-cement pipe, asbestos-cement sheet, asbestos paper (starch and elastomeric binders), asbestos millboard, asbestos roofing products, and asbestos floor tile.

Impact of the "Best Practicable Technology" (BPT) Standards

The total capital costs to the various segments for meeting the 1977 BPT standards are estimated to be:

Asbestos-cement Pipe Manufacturing	$ 700,000
Asbestos-cement Sheet Manufacturing	655,000
Asbestos Paper Manufacturing	650,000
Asbestos Millboard Manufacturing	147,000
Asbestos Roofing Manufacturing	103,000
Asbestos Floor Tile Manufacturing	673,000
Total for the industry	$2,928,000

As a proportion of the estimated annual sales of these products, these required capital expenditures generally amount to less than 1.8 percent and are thought to be well within the capital-raising capability of the large diversified firms involved in the manufacture of these product lines. However, since these segments generally employ extensively depreciated equipments and have not invested to a significant degree in new capital equipments for the past several years, the above capital cost estimates, when viewed as a percentage of average annual investments in these product lines, are distorted on the high side. It is for this reason that the estimated BPT-related capital expenditures represent between 12 and 58 percent of these annual investments.

The annualized costs to the respective segments for achieving the BPT standards amount to the following percentages of the 1972 sales of the respective products:

Asbestos-cement Pipe Manufacturing	-	0.2%
Asbestos-cement Sheet Manufacturing	-	0.4%
Asbestos Paper Manufacturing	-	0.2%
Asbestos Millboard Manufacturing	-	1.0%
Asbestos Roofing Manufacturing	-	0.8%
Asbestos Floor Tile Manufacturing	-	0.1%

It is concluded that these additional costs would not exert a significant impact on the prices and the market competitiveness of the respective products vis-vis imports and substitute materials. In fact, it is probable

that, in general, manufacturers of these products may tend to absorb these costs not only because they are relatively negligible, but also because the above products have, in recent years, been confronting stiff market competition from other competitive substitute products. If the costs are absorbed, the effect of such action on overall corporate profitability is expected to be minimal, especially in light of the fact that virtually all the asbestos products manufacturers are extensively diversified into apparently more profitable non-asbestos manufacturing.

However, three plants,--one sheet and two millboard,--were identified, solely on the basis of these additional costs and without evaluation of other factors that may impinge on this decision, as potential candidates for shut-down. If shut-down should indeed occur, the resultant loss of employment would amount to about 2% (275 employees) of the total industry workforce. In spite of the fact that the impacted sheet plant is located in an area of "substantial unemployment" and one of the millboard plants is in an area of "persistent unemployment," no significant adverse community impacts would result, although laid-off individuals would have to contend with personal adverse impacts and inconveniences.

In terms of the national balance of payments, it is expected that the past trend in favor of the United States would continue, essentially unaffected by the BPT standards, but with the gap narrowing with time as indigenous manufacturing capability is developed in foreign countries.

Impact of "Best Available Technology" (BAT) Standards

Assuming that the industry installed effluent treatment facilities which, in a single step would bring their present (1972) operations into compliance with the BAT standards, the associated capital expenditures are estimated to be:

Asbestos-cement Pipe Manufacturing	$1,668,000
Asbestos-cement Sheet Manufacturing	1,434,000
Asbestos Paper Manufacturing	1,253,000
Asbestos Millboard Manufacturing	147,000
Asbestos Roofing Manufacturing	256,000
Asbestos Floor Tile Manufacturing	1,752,000
Total for the industry	$6,510,000

It is not expected that capital expenditures of this magnitude would pose any undue problems to any of the industry segments concerned.

As for the annualized additional costs associated with meeting these standards, they represent the following proportions of the estimated 1972 sales of the subject asbestos products:

Asbestos-cement Pipe	-	0.4%
Asbestos-cement Sheet	-	1.0%
Asbestos Paper	-	0.6%
Asbestos Millboard	-	1.0%
Asbestos Roofing	-	1.1%
Asbestos Floor Tile	-	0.1%

A survey of the water treatment needs of the various manufacturing plants shows that one asbestos paper plant, in addition to the three facilities identified as potentially impact-sensitive by reason of the BPT guidelines, is expected to be adversely impacted by implementation of the BAT standards. The total loss of sales potentially relatable to the BAT effluent standards would equal about 0.6%, with the loss of employment amounting to 2.4% of the work-force. No adverse community impact is anticipated and neither is a substantial effect on the national balance of payment to be expected.

Impact of New Source Performance Standards

The analysis based on these standards indicates no adverse effects on the growth of the industry as a direct consequence of the proposed new source standards. Even in the absence of these standards, growth would at best be slow. The additional capital and operating costs arising from the BPT and BAT effluent guidelines should not significantly affect the price structure and market competitiveness of the respective products; nor is it expected that these costs, of themselves, would constitute a significant inducement for U.S. manufacturers to preferentially locate new facilities at foreign sites, with its consequent potentially adverse effects on the national balance of trade and payments (and loss of related domestic employment).

INDUSTRY SUMMARY

Industry: Asbestos Industry Segment: Asbestos-Cement Pipe
SIC Code: 3292

Plants in segment . . . . . About 15
% Total plants in industry . . . 18.8%

Plants direct discharging . . 2
% Total plants in segment . . . 13%

Plants with BPT treatment in place . . . 6 (with BPT or better)
% Total plants in segment 40%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$700,000	$1,668,000
Total capital expenditures as % of average annual investment	14.5%#	34.5%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges . .	$345,000	$604,000
Total incremental increase excluding capital charges . .	$317,400	$555,680
Total incremental increase including capital charges as % of sales	0.22%	0.38%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	None	None
PLANT CLOSURES		
Total closures anticipated . . .	0	0
% reduction of segment capacity due to closures . . .	0	0
EMPLOYMENT		
Total # of employees affected . .	0	0
% of total employees in segment	0	0
COMMUNITY EFFECTS	None	None
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

INDUSTRY SUMMARY

Industry: Asbestos Industry Segment: Asbestos-Cement Sheet
SIC Code: 3292

Plants in segment . . . . . About 14
% Total plants in industry . . . 17.5%

Plants direct discharging . . 5
% Total plants in segment . . . 35%

Plants with BPT treatment in place . . . 2
% Total plants in segment 14.3%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$655,000	$1,434,000
Total capital expenditures as % of average annual investment	21.1%#	46.23%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges . .	$472,000	$1,152,000
Total incremental increase excluding capital charges . .	$434,240	$1,059,840
Total incremental increase including capital charges as % of sales	0.47%	1.2%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	None	None
PLANT CLOSURES		
Total closures anticipated	1	1
% reduction of segment capacity due to closures	1%	1%
EMPLOYMENT		
Total # of employees affected . .	30	30
% of total employees in segment	1%	1%
COMMUNITY EFFECTS	Not Significant	Not Significant
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

INDUSTRY SUMMARY

Industry: Asbestos Industry
SIC Code: 3292
Segment: Asbestos Paper

Plants in segment . . . . . About 12
% Total plants in industry . . . 15%

Plants direct discharging . . 2
% Total plants in segment . . . 16.7%

Plants with BPT treatment in place . . . 10
% Total plants in segment 83.3%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$650,000	$1,253,000
Total capital expenditures as % of average annual investment	20.7%#	39.9%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges . .	$190,000	$614,000
Total incremental increase excluding capital charges . .	$174,800	$564,880
Total incremental increase including capital charges as % of sales	0.18%	0.64%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	Not Significant	Not Significant
PLANT CLOSURES		
Total closures anticipated . . .	0	1
% reduction of segment capacity due to closures . . .	0	0.3%
EMPLOYMENT		
Total # of employees affected . .	0	15
% of total employees in segment	0	2.4%
COMMUNITY EFFECTS	None	None
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

INDUSTRY SUMMARY

Industry: Asbestos Industry Segment: Asbestos Millboard
SIC Code: 3292

Plants in segment . . . . . About 7
% Total plants in industry . . . 8.8%

Plants direct discharging . . 2
% Total plants in segment . . . 28.6%

Plants with BPT treatment in place . . . 2
% Total plants in segment 28.6%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$147,000	$147,000
Total capital expenditures as % of average annual investment	55.3%#	55.3%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges . .	$90,000	$90,000
Total incremental increase excluding capital charges . .	$82,800	$82,800
Total incremental increase including capital charges as % of sales	1.04%	1.04%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	Not Significant	Not Significant
PLANT CLOSURES		
Total closures anticipated . . .	2	2
% reduction of segment capacity due to closures . . .	22%	22%
EMPLOYMENT		
Total # of employees affected . .	240	240
% of total employees in segment	22%	22%
COMMUNITY EFFECTS	Not Significant	Not Significant
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

INDUSTRY SUMMARY

Industry: Asbestos Industry Segment: Asbestos Roofing
SIC Code: 3292

# Plants in segment	About 10
% Total plants in industry	12.5%
# Plants direct discharging	6
% Total plants in segment	60%
# Plants with BPT treatment in place	4 (with BPT or better)
% Total plants in segment	40%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$103,000	$256,000
Total capital expenditures as % of average annual investment	57.9%#	143.8%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges	$47,000	$69,000
Total incremental increase excluding capital charges	$43,240	$63,480
Total incremental increase including capital charges as % of sales	0.81%	1.20%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	Not Significant	Not Significant
PLANT CLOSURES		
Total closures anticipated	0	0
% reduction of segment capacity due to closures	0	0
EMPLOYMENT		
Total # of employees affected	0	0
% of total employees in segment	0	0
COMMUNITY EFFECTS	None	None
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

INDUSTRY SUMMARY

Industry: Asbestos Industry
SIC Code: 3292

Segment: Asbestos Floor Tile

# Plants in segment	About 22
% Total plants in industry	27.5%
# Plants direct discharging	17
% Total plants in segment	77.3%
# Plants with BPT treatment in place	5
% Total plants in segment	22.7%

	BPT	BAT*
COST OF POLLUTION ABATEMENT		
Capital costs for segment		
Total capital cost	$673,000	$1,752,000
Total capital expenditures as % of average annual investment	11.9%#	30.9%#
Total capital expenditures as % of total capital in place	N.A.	N.A.
Annualized costs for segment		
Total incremental increase including capital charges	$245,000	$357,000
Total incremental increase excluding capital charges	$225,400	$328,440
Total incremental increase including capital charges as % of sales	0.1%	0.2%
EXPECTED PRICE INCREASE		
Expected increase due to pollution control	Not Significant	Not Significant
PLANT CLOSURES		
Total closures anticipated	0	0
% reduction of segment capacity due to closures	0	0
EMPLOYMENT		
Total # of employees affected	0	0
% of total employees in segment	0	0
COMMUNITY EFFECTS	None	None
IMPACT ON INDUSTRY GROWTH	None	None
BALANCE OF TRADE EFFECTS	None	None

*Assumes single-step up-grading to BAT standards without BPT intermediate.
#Based on average annual investment equivalent to 3.1% of annual sales for the SIC 3292 category (U.S. Bureau of the Census historical data).

PART I: INDUSTRY STRUCTURE

TYPES OF FIRMS

According to the 1967 U.S. Census of Manufactures, 81 firms (operating 138 establishments) were involved in asbestos products manufacturing, (SIC 3292). The distribution of these facilities as a function of the legal organization structure of the controlling firms is shown in Table 1. It is evident that corporations dominate the asbestos manufacturing industry, controlling about 84 percent of the physical facilities and about 99.5 percent of the workforce of the asbestos products sector. It is not certain what proportion of these firms are public corporations. The participation of the individual owner or partnerships is negligible.

Shown in Table II is a grouping of the facilities in terms of the types of operations. Multi-unit corporations dominate the asbestos products manufacturing industry and provide most of the employment, accounting for about 96 percent of the total employment.

In evaluating the asbestos products manufacturing industry, one easily arrives at the conclusion that it is disproportionately dominated by a few giant firms. These are listed in Table III, along with the estimates of their total number of employees, annual sales, principal asbestos-related products, and major asbestos manufacturing facilities. Note that the total employment and sales shown do not necessarily reflect only asbestos-based manufacturing since these large firms are generally diversified into other product lines. Table IV shows the proportions of the major manufacturers' product lines that are related to asbestos.

It is estimated that there are presently about 80 firms engaged in asbestos products manufacture. The historical trend in the number of firms is shown in Table V and Figure 1.

To illustrate the intensive domination of the industry by a few select firms listed in Table III, Table VI shows the historical trends in the percentages of the industry's shipments accounted for by the largest companies. The four largest producers have historically accounted for well over 50 percent of the industry (value of) shipments. For the eight largest firms, the figure is consistently about 75 percent. It is believed that these distributions are still viable in 1973.

A useful yardstick for measuring the level of plant and product diversification of the asbestos manufacturing industry is the "specialization ratio" which is a measure of the extent to which plants classified in this industry specialize in making asbestos products. To derive this factor, the value of shipments of asbestos products by plants in this industry segment is expressed as a ratio of the total shipments of all products made by these plants. Another useful criterion is the "coverage ratio" which measures the extent to which all shipments of asbestos products are made by plants classified in this industry, as distinguished from secondary producers elsewhere; in other words, the value of shipments of asbestos products made by plants classified in this industry expressed as a ratio of the total shipments of asbestos products made by all producers, both in and out of the asbestos products manufacturing industry.

TABLE I

DISTRIBUTION OF ASBESTOS PRODUCTS MANUFACTURING FACILITIES BY LEGAL ORGANIZATIONAL FORM

Industry Sector	Form of Organization	No. of Facilities		Total Number of Employees
		Total	with 20 Or more employees	
Asbestos Products	Corporate	116	99	21,200
	Noncorporate	6	--	< 50
	Administrative Records	16	--	< 50
	Total	138	99	~21,300

Source: 1967 U.S. Census of Manufacturers

TABLE II

DISTRIBUTION OF ASBESTOS PRODUCTS MANUFACTURING FACILITIES BY TYPES OF OPERATION

Industry Sector	Type of Operation	No. of Facilities		Total Number of Employees
		Total	of 20 or more employees	
Asbestos Products	Multi-unit corporations	89	84	20,400
	Single-unit corporations	27	15	800
	Single-unit non-corporations	6	0	< 50
	Administrative Records	16	0	< 50
	Total	138	99	~ 21,300

Source: 1967 U.S. Census of Manufacturers

TABLE III

THE MAJOR ASBESTOS MANUFACTURING FIRMS AND PLANTS IN THE UNITED STATES

Company	Total Number of Employees	Estimated Annual Sales ($000,000)	Principal Asbestos-Based Products Manufactured	Plants/Establishments Manufacturing Asbestos Products
American Biltrite Rubber Corp.	about 4,500; 20% involved in asbestos products	161.0	Floor tiles	14 plants involved to some degree in asbestos manufacturing
Armstrong Cork Co.	21,000; about 80% involved in asbestos products	550.0-600.0	Gaskets & insulating materials; vinyl asbestos tile	Fulton, N. Y. Jackson, Miss. Kankakee, Ill. Lancaster, Pa. South Gate, Cal.
Certain-Teed Products Corp.	7,600	332.0	Roofing products; asbestos-cement pipes & fittings	Santa Clara, Cal. Riverside, Cal. Ambler, Pa. Hillsboro, Texas St. Louis, Mo.
The Flintkote Company	11,300	441.0	Asbestos-cement pipe; vinyl asbestos tiles; roofing products	Los Angeles, Cal. Chicago Heights, Ill. New Orleans, La. Ravenna, Ohio Chillicothe, Ohio
GAF Corporation	20,000 Its subsidiary, Ruberoid, is probably the sole producer of asbestos products	768.0	Asbestos-cement products; vinyl asbestos tiles; roofing products; asbestos paper	Mobile, Ala. Long Beach, Cal. Joliet, Ill. Millis, Mass. St. Louis, Mo. South Bound Brook, N. J. Vails Gate, N. Y. Erie, Pa. (two plants) Whitehall, Pa. Houston, Texas

Arthur D Little Inc

TABLE III, continued

Company	Total Number of Employees	Estimated Annual Sales ($000,000)	Principal Asbestos-Based Products Manufactured	Plants/Establishments Manufacturing Asbestos Products
Jim Walter Corp.	1,000 in asbestos products manufacture	882.0	Roofing materials	Perth Amboy, N. J. Linden, N. J. Memphis, Tenn. Lockland, Ohio Miamisburg, Ohio Wilmington, Del. Houston, Texas Tampa, Fla. Cincinnati, Ohio
Johns-Manville Products Corp.	25,200	796.0	Asbestos-cement products; asbestos roofing; asbestos insulating materials; millboard	Nashua, N. H. Manville, N. J. Pittsburg, Cal. Stockton, Cal. Waukegan, Ill. Marrero, La. Long Beach, Cal. Los Angeles, Cal. Green Cove Springs, Fla. Savannah, Ga. Billerica, Mass. Tilton, N. H. Denison, Texas Forth Worth, Texas
Nicolet Industries, Inc.	350	15.0	Asbestos paper; asbestos millboard	Ambler, Pa. Norristown, Pa. Hamilton, Ohio
National Gypsum Co.	14,500	519.0	Asbestos-cement products; asbestos roofing; insulating board	New Orleans, La. Millington, N. J. Mobile, Ala.

Arthur D Little Inc.

TABLE IV

ASBESTOS-BASED ACTIVITY OF THE MAJOR ASBESTOS-MANUFACTURING COMPANIES

Company	Estimated Annual Sales ($000,000)	Percent of Product Line Related to Asbestos
American Biltrite Rubber Co.	161	5
Armstrong Cork Co.	600.0	50
The Flintkote Co.	441.0	20
GAF Corp.	768.0	5
Johns-Manville Corp.	796.0	30
National Gypsum Co.	519.0	10
Jim Walter Corp.	882.0	12

Source: Company and Trade Reports and Contractor's Estimates

The historical trends in these ratios are shown in Table VII. It is evident that plants in this industry tend to be very specialized, with about 90 percent of their shipments accounted for by asbestos products. The coverage ratio indicates that asbestos products manufacturers historically capture over 90 percent of the market for their primary products.

A review of the sources of primary asbestos fiber indicates that some of the major asbestos manufacturers are integrated backwards to the mines. These are firms of the vertical type which exercise substantial control over their raw materials sources. The mines owned and/or operated by asbestos manufacturers are shown in Table VIII.

TYPES OF PLANTS

As discussed previously, asbestos products manufacturing facilities are characterized by very high specialization ratios (90 percent). Thus the typical plant (especially of the minor manufacturers) is apt to be a single-product operation whose product is geared to service a specific industry within a restricted geographical region.

A survey of selected facilities shows that nearly all the large plants employing in excess of 100 workers belong to the major firms within the industry, such facilities also often generating relatively minor proportions of non-asbestos products.

TABLE V

TRENDS IN THE NUMBER OF ASBESTOS PRODUCTS MANUFACTURING COMPANIES

Product	Year	Number of Companies
Asbestos Products	1947	85
	1954	74
	1958	69
	1963	73
	1967	81
	1973	80

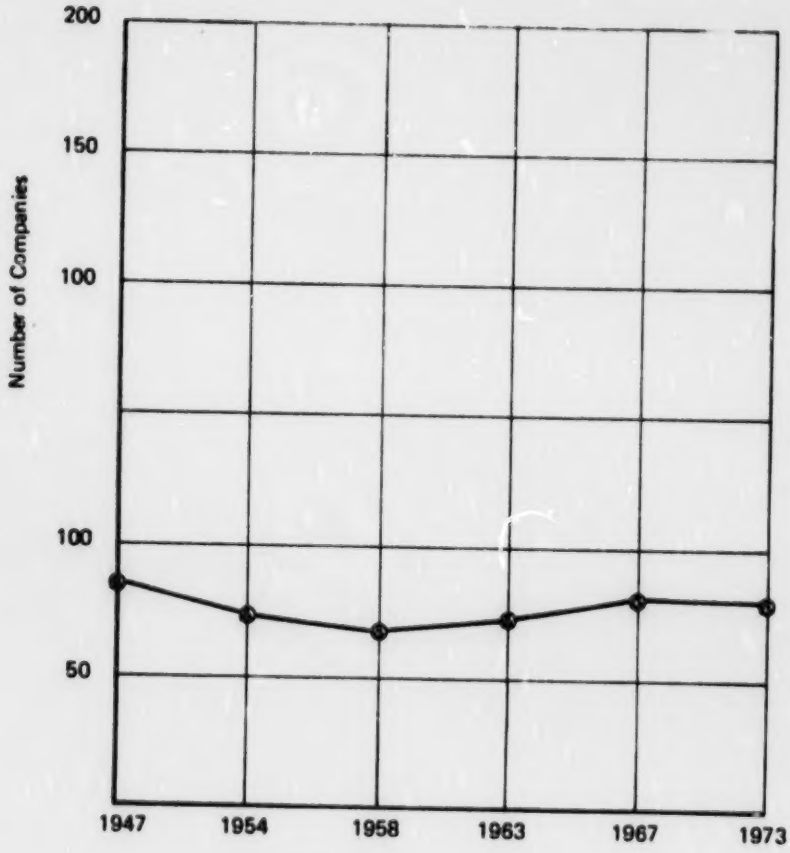
Sources: 1947-1967 1967 U. S. Census of Manufacturers
1967-1973 Contractor's Estimates

TABLE VI

PROPORTION OF SHIPMENTS ACCOUNTED FOR BY THE LARGEST COMPANIES

Product	Year	Percent of Value of Shipments Accounted for By: Largest Companies			
		4	8	20	50
Asbestos Products	1954	60	77	NA	NA
	1958	59	76	95	99
	1963	56	76	95	99+
	1966	56	74	NA	NA
	1967	55	75	94	99+

Source: 1967 U.S. Census of Manufacturers



Sources: 1947–1967–1967 U.S. Census of Manufactures.
1973 – Contractor's estimates

FIGURE 1 HISTORICAL TREND IN THE NUMBER OF COMPANIES INVOLVED IN ASBESTOS PRODUCTS MANUFACTURING

TABLE VII

SPECIALIZATION AND COVERAGE RATIOS FOR THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY

Product	Year	Primary Product Specialization Ratio (%)	Coverage Ratio (%)
Asbestos Products	1947	87	90
	1954	87	93
	1958	89	92
	1963	95	91
	1967	93	90

Source: 1967 U. S. Census of Manufacturers

The locational characteristics of asbestos products manufacturing facilities correspond to the major markets served -- automotive and construction industries. Thus, plants tend to be concentrated near the major metropolitan centers of the United States. The geographical distributions of the plants of the major manufacturing firms are shown in Figures 2 to 7 for each of the six product categories of interest.

It is fair to state that the asbestos manufacturing industry in the United States is very mature, with most of the larger plants well over 25 years old and employing well-established technologies. For instance, asbestos-cement pipe manufacture was introduced in the United States about 1928 by the Johns-Manville Corporation at its Waukegan, Illinois, plant. Except for incorporation of sophisticated controls and materials handling systems, it is doubtful whether the technology, similar in principle to that employed in the manufacture of flat or corrugated sheeting, has changed to any fundamental extent since then. Similar comments may be applied to the manufacture of vinyl asbestos tiles. In light of the domestic market position of asbestos products, viz-a-viz competitive materials, it is not expected that any major new facilities or technologies will be instituted during the remainder of this decade.

TABLE VIII

CAPTIVE FIBER SOURCES FOR THE MAJOR ASBESTOS PRODUCTS MANUFACTURING FIRMS

Company	Captive Mine(s)	Fiber-Producing Capacity (short tons/year)
The Flintkote Co.	Flintkote Mines, Ltd. Quebec (wholly owned subsidiary)	33,000
GAF Corp.	Captive mines in Vermont	40,000
ASARCO (through CAPCO, 40% owned by ASARCO)	Lake Asbestos of Quebec, Ltd.	150,000
Johns-Manville Products Corp.	Canadian Johns-Manville Co., Ltd.	835,000
	Coalinga Asbestos Corp., Cal. (80% interest)	15,000
National Gypsum Co.	National Asbestos* Mines, Ltd.	60,000
Jim Walter Corp.	Carey - Canadian Mines,Ltd.	200,000
H. K. Porter Co., Inc.	Pacific Asbestos Corp.	50,000
Raybestos-Manhattan, Inc.	Cassiar Asbestos Corp. (partial interest)	110,000
General Dynamics Corp.	Asbestos Corp., Ltd. (54% interest)	500,000
Union Carbide Corp.	Union Carbide Mines, California	10,000

*National Gypsum is negotiating the sale of its assets to Lake Asbestos of Quebec, Ltd. Sale is expected to be consummated in September 1973.

FIGURE 2 GEOGRAPHICAL LOCATION OF THE MAJOR ASBESTOS-CEMENT PLANTS IN THE UNITED STATES

FIGURE 3 GEOGRAPHICAL LOCATION OF THE MAJOR ASBESTOS-CEMENT SHEET PLANTS IN THE UNITED STATES

FIGURE 4 GEOGRAPHICAL LOCATION OF THE MAJOR ASBESTOS MILLBOARD PLANTS IN THE UNITED STATES

FIGURE 5 GEOGRAPHICAL LOCATION OF THE MAJOR ASBESTOS PAPER PLANTS IN THE UNITED STATES

FIGURE 8 GEOGRAPHICAL LOCATION OF THE MAJOR ASBESTOS ROOFING PLANTS IN THE UNITED STATES

FIGURE 7 GEOGRAPHICAL LOCATION OF THE MAJOR VINYL-ASBESTOS FLOOR TILE PLANTS IN THE UNITED STATES

NUMERICAL AND PERCENTAGE DISTRIBUTION OF PLANTS, EMPLOYEES AND PRODUCTION

The numerical distribution of the establishments by size (expressed in terms of the number of employees) as given by the 1967 Census of Manufactures is shown in Table IX and depicted graphically in Figure 8.

This distribution is even more skewed when viewed in terms of the total and cumulative employment per size category. This is illustrated in Table X and shown graphically in Figure 9. A comparison of Figures 8 and 9 shows that whereas facilities with less than 100 employees account for 55 percent of the number of asbestos products manufacturing establishments, these facilities employ only about 9 percent of the workforce.

The relatively minor contributions of the less-than-100 employee facilities in the industry are further illustrated in Tables XI and XII, and Figures 10 and 11 which show the distribution of total payroll and value-added-by-manufacture as functions of facility sizes. The segment with less than 100 employees per establishment contributes only 8.1 percent of the payroll and generates only 7.4 percent of the value added by manufacture. These figures again underline that in terms of economic impact, those segments of the industry employing less than 100 workers per facility exert relatively little influence. The economic punch appears clearly to rest with the major manufacturing units.

Other economic indicators that support the same thesis are the value of shipments and the new capital expenditures for the various size categories -- Tables XIII and XIV and Figures 12 and 13. Operations with fewer than 100 employees account for 8.6 percent of the shipments and a mere 8.3 percent of the new capital investments.

It should be observed that although the preceding data imply that a certain number of facilities are in the under-50-employees category, such small facilities are more apt to be involved in the manufacture of products outside the scope of the present study, i.e. friction materials. In fact, in view of the relatively low unit value of the products studied--asbestos-cement pipe and sheet, asbestos millboard, paper, and floor tile,--coupled with the fact that large throughputs are necessary to economically justify the continued operation of any facility manufacturing these specific products, it can justifiably be stated that virtually all the facilities of any consequence employ in excess of 50 workers.

There is the additional consideration that, for a given asbestos product, the manufacturing equipment tends to be of a given standard capacity. Differences in plant capacities are therefore determined approximately by the number of installed machines, and capacity differences therefore occur in multiples of one standard machine capacity. As such, since a machine requires over 50 men to keep it in operation, it becomes evident why, for the specific products assessed, plants with less than about 50 employees are the exception.

Since the plants manufacturing a given product may thus be regarded

TABLE IX

ASBESTOS PRODUCTS MANUFACTURE: DISTRIBUTION OF PLANT SIZES

Average Number of Employees	Total No. of Establishments	Cumulative Percent of Total
1 to 4	20	14.5
5 to 9	7	19.6
10 to 19	12	28.3
20 to 49	14	38.4
50 to 99	23	55.1
100 to 249	36	81.2
250 to 499	18	94.2
500 to 999	6	98.6
1000 to 2499	2	100.0
TOTAL	138	

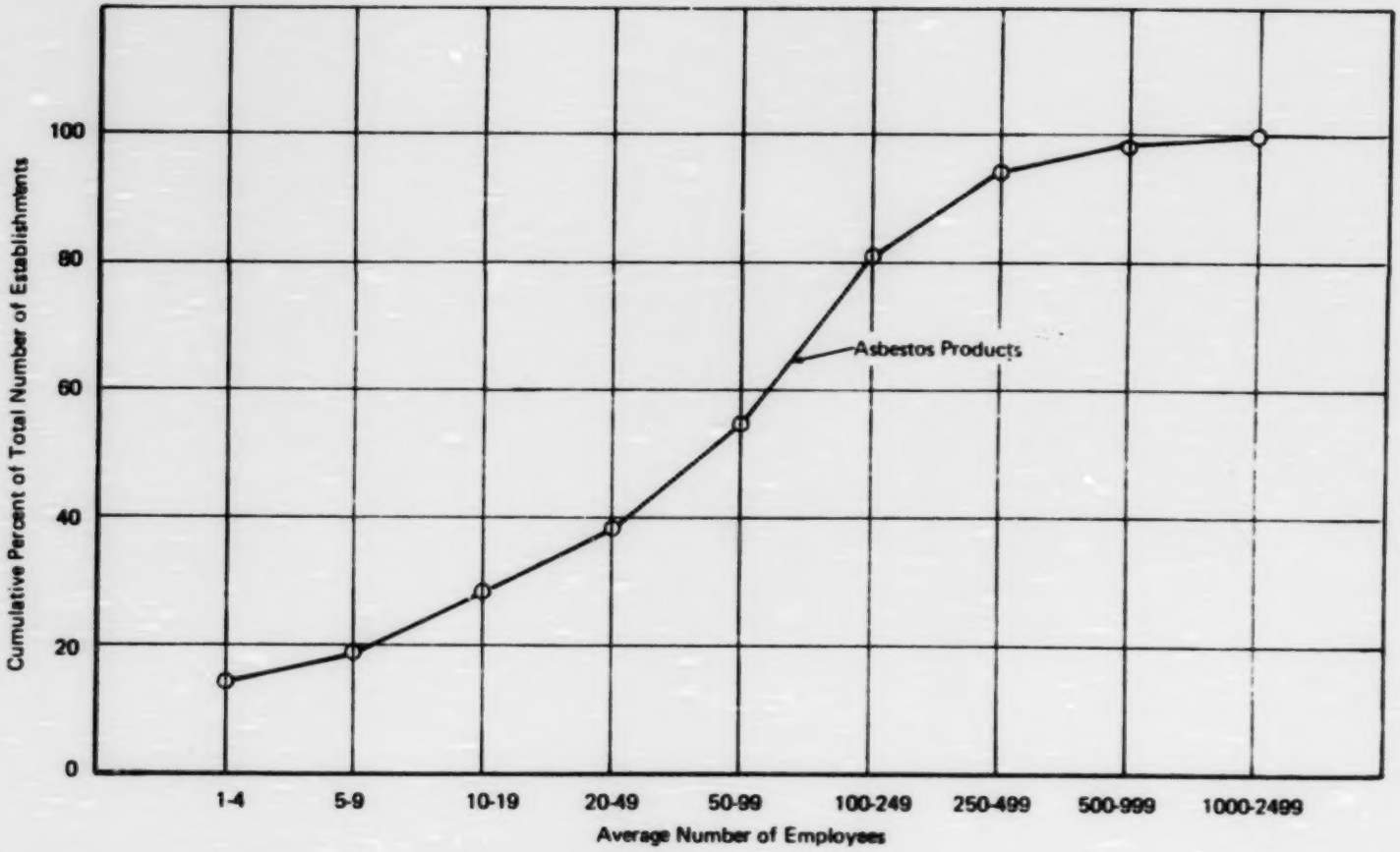
Source: 1967 U. S. Census of Manufacturers

TABLE X

ASBESTOS PRODUCTS MANUFACTURING: TOTAL EMPLOYMENT AS A FUNCTION OF SIZE OF FACILITIES

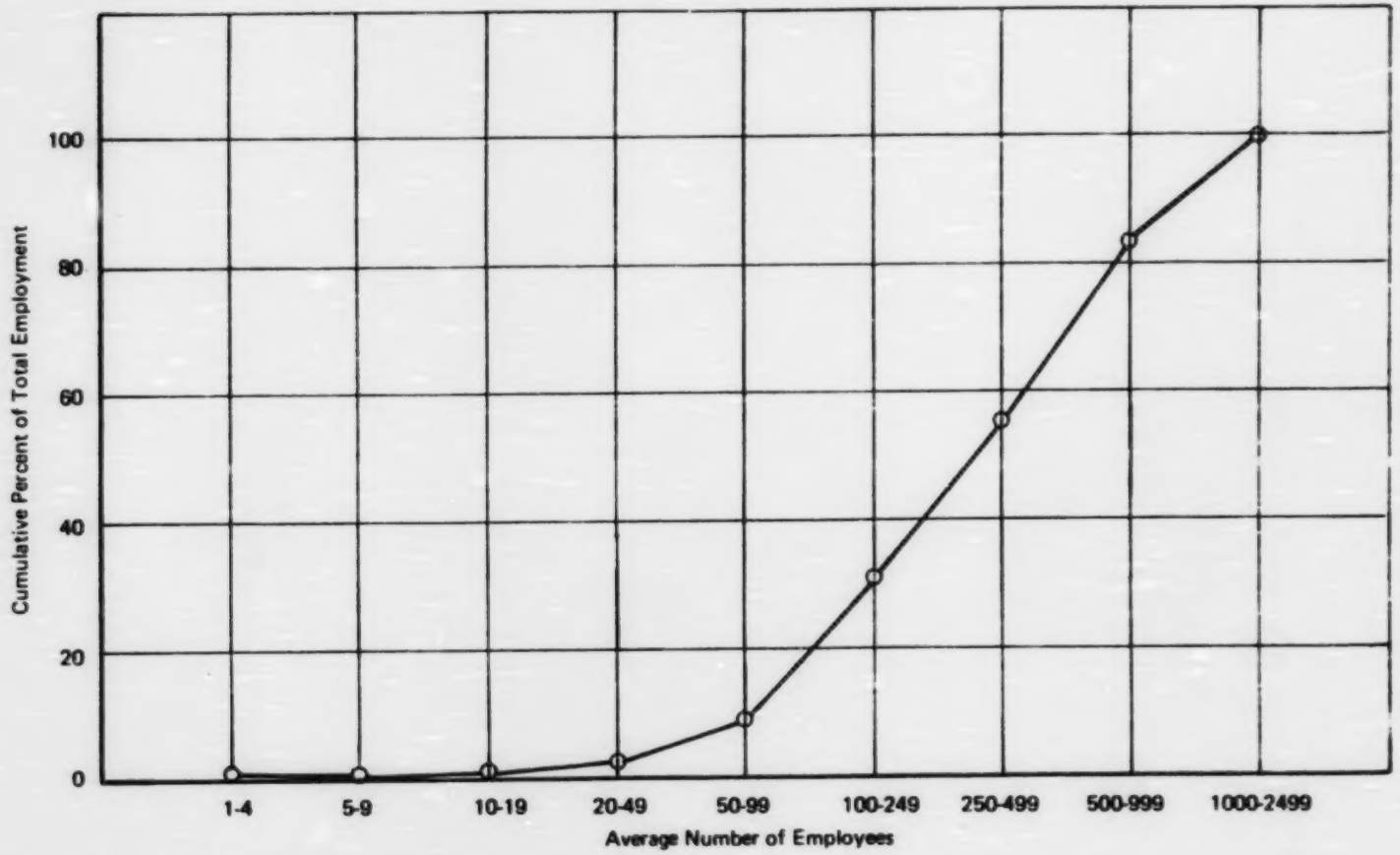
Average Number of Employees	Total No. of Employees	Cumulative Percent of Total
1 to 4	40*	0.2
5 to 9	45*	0.3
10 to 19	200	1.1
20 to 49	400	2.7
50 to 99	1,700	9.3
100 to 249	5,600	31.2
250 to 499	6,100	55.1
500 to 999	7,300	83.6
1000 to 2499	4,200*	100.0
TOTAL	25,585	

*Contractor's Estimate
Source: Unless where otherwise indicated, 1967 U.S. Census of Manufacturers



Source: 1967 U.S. Census of Manufactures.

FIGURE 8 CUMULATIVE DISTRIBUTION OF ASBESTOS PRODUCTS MANUFACTURING FACILITIES AS A FUNCTION OF PLANT SIZE



Source: 1967 U.S. Census of Manufactures.

FIGURE 9 ASBESTOS PRODUCTS MANUFACTURING INDUSTRY – CUMULATIVE EMPLOYMENT VERSUS SIZE OF FACILITIES

TABLE XI

ASBESTOS PRODUCTS MANUFACTURING: TOTAL PAYROLL AS A FUNCTION OF SIZE OF FACILITIES

Average Number of Employees	Payroll ($\$10^6$)	Cumulative Percent of Sector Total
1 to 4	0.2	0.1
5 to 9	0.3	0.3
10 to 19	1.0	0.9
20 to 49	2.6	2.4
50 to 99	10.0	8.1
100 to 249	36.9	29.4
250 to 499	42.2	53.7
500 to 999	50.8	83.0
1000 to 2499	29.4*	100.0
TOTAL	173.4	

*Contractor's estimates on the basis of average payroll per employee of $7,000

**Contractor's estimates on the basis of average payroll per employee of $6,300

Source: Unless where otherwise indicated, 1967 U. S. Census of Manufacturers

as relatively large, size considerations appear inadequate as a criterion for assessing plant sensitivity to impact arising from the proposed effluent guidelines. Therefore, the impact analysis will be based on plant-by-plant assessment of a significant cross-section of the facilities generating a given product.

FINANCIAL PROFILE

The Bureau of the Census data indicate a definite stability in several important economic indicators for the asbestos product manufacturing industry over the past decade. The exceptions are the increases since 1967 in the value of shipments and the value of shipments per employee, and the decline in industry employment. There has also been a reduced inventory turnover over the last several years, although the industry's turnover still remains well above the average for manufacturing

TABLE XII

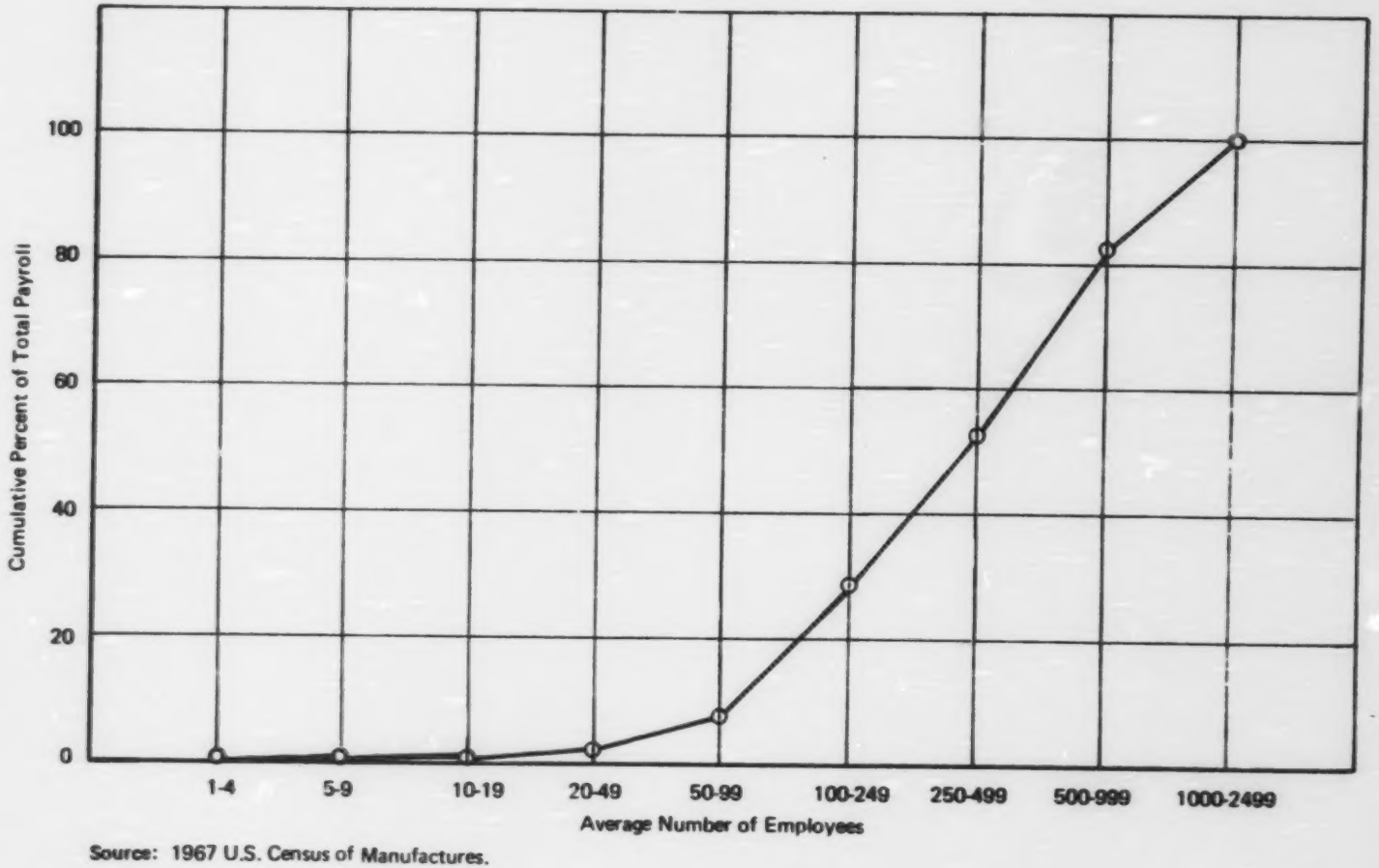
ASBESTOS PRODUCTS MANUFACTURING: VALUE ADDED BY MANUFACTURE AS A FUNCTION OF FACILITY SIZES

Average Number of Employees	Total Value	Cumulative Percent of Sector Total
1 to 4	0.4	0.1
5 to 9	0.5	0.2
10 to 19	2.4	0.8
20 to 49	5.0	2.1
50 to 99	19.4	7.4
100 to 249	84.2	30.2
250 to 499	98.2	56.9
500 to 999	97.9	83.4
1000 to 2499	60.8*	100.0
TOTAL	368.8	

*Contractor's estimates on the basis of (1967) value added per employee of $14,470

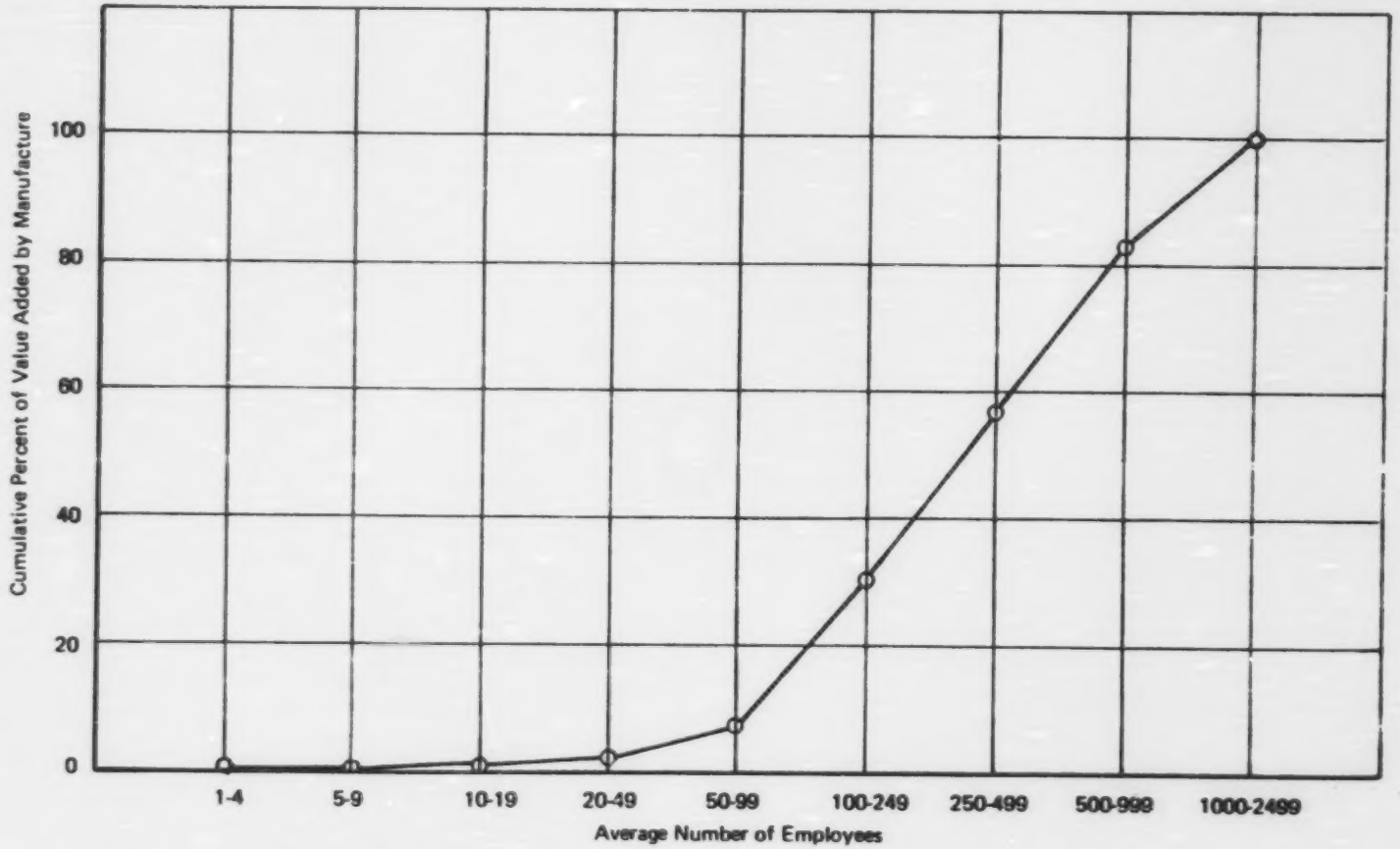
Source: 1967 U. S. Census of Manufacturers

*Includes only shipment of products within the scope of this report.



Source: 1967 U.S. Census of Manufactures.

FIGURE 10 THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY - PAYROLL DISTRIBUTION AS A FUNCTION OF FACILITY SIZES



Source: 1967 U.S. Census of Manufactures.

FIGURE 11 THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY-VALUE ADDED BY MANUFACTURE AS A FUNCTION OF SIZES OF FACILITIES

TABLE XIII

ASBESTOS PRODUCTS MANUFACTURING: VALUE OF SHIPMENTS VERSUS PLANT SIZE

Average Number of Employees	Value of Shipments ($\$10^6$)	Cumulative Percent of Total
1 to 4	0.6	0.1
5 to 9	0.9	0.2
10 to 19	4.2	0.9
20 to 49	11.3	2.5
50 to 99	40.6	8.6
100 to 249	169.3	34.0
250 to 499	186.4	61.9
500 to 999	161.7	86.2
1000 to 2499	92.4*	100.0
TOTAL	667.4	

* Contractor's estimates based on value of shipments per employee of $22,000

Source: 1967 U. S. Census of Manufacturers

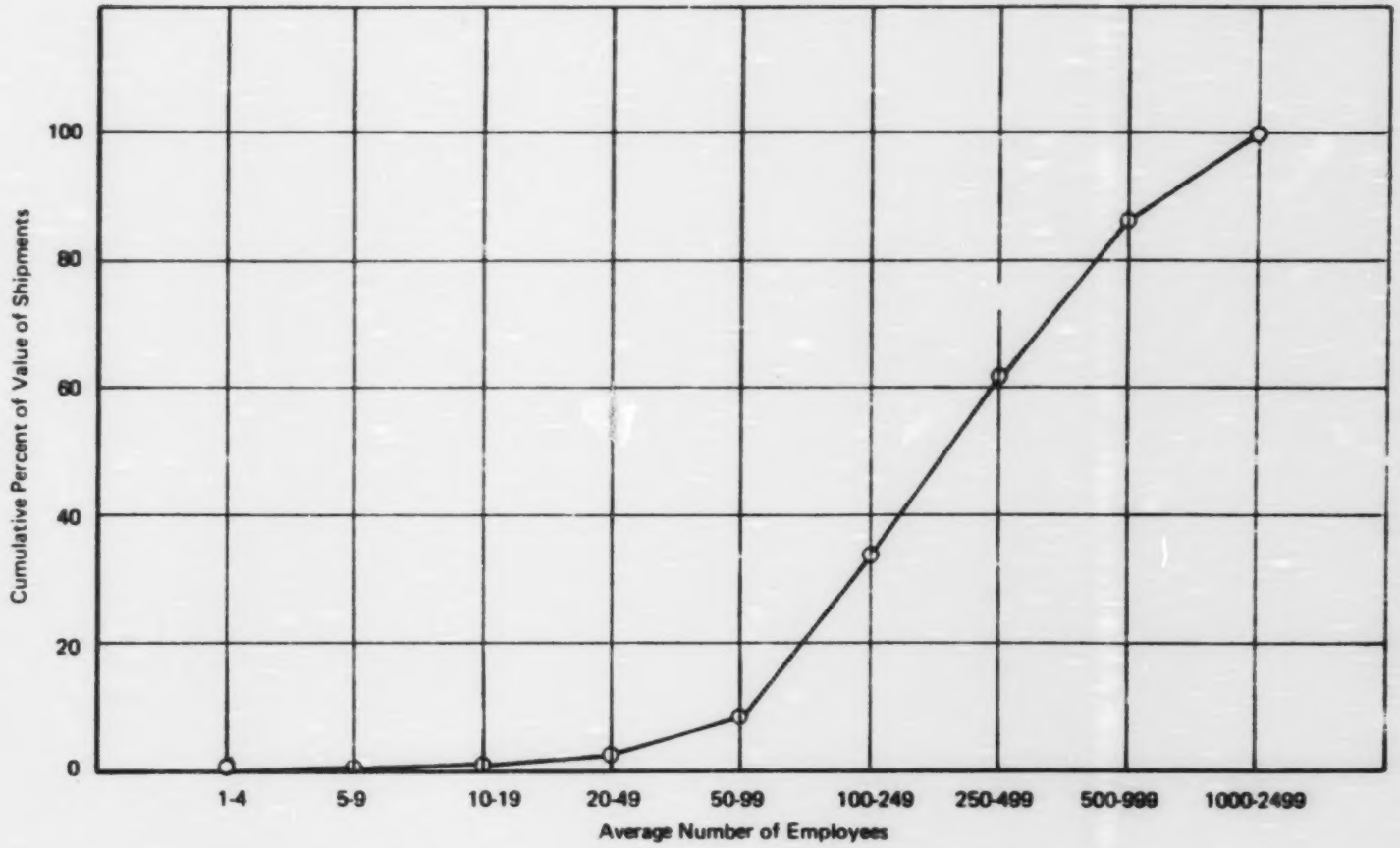
TABLE XIV

ASBESTOS PRODUCTS MANUFACTURING: NEW CAPITAL EXPENDITURES VERSUS PLANT SIZE

Average Number of Employees	Capital Expenditures ($\$10^6$)	Cumulative Percent of Total
1 to 4	0.04*	0.2
5 to 9	0.03*	0.4
10 to 19	0.2*	1.5
20 to 49	0.1*	2.1
50 to 99	1.1	8.3
100 to 249	4.2	31.9
250 to 499	6.6	69.0
500 to 999	3.9	91.0
1000 to 2499	1.6*	100.0
TOTAL	17.77	

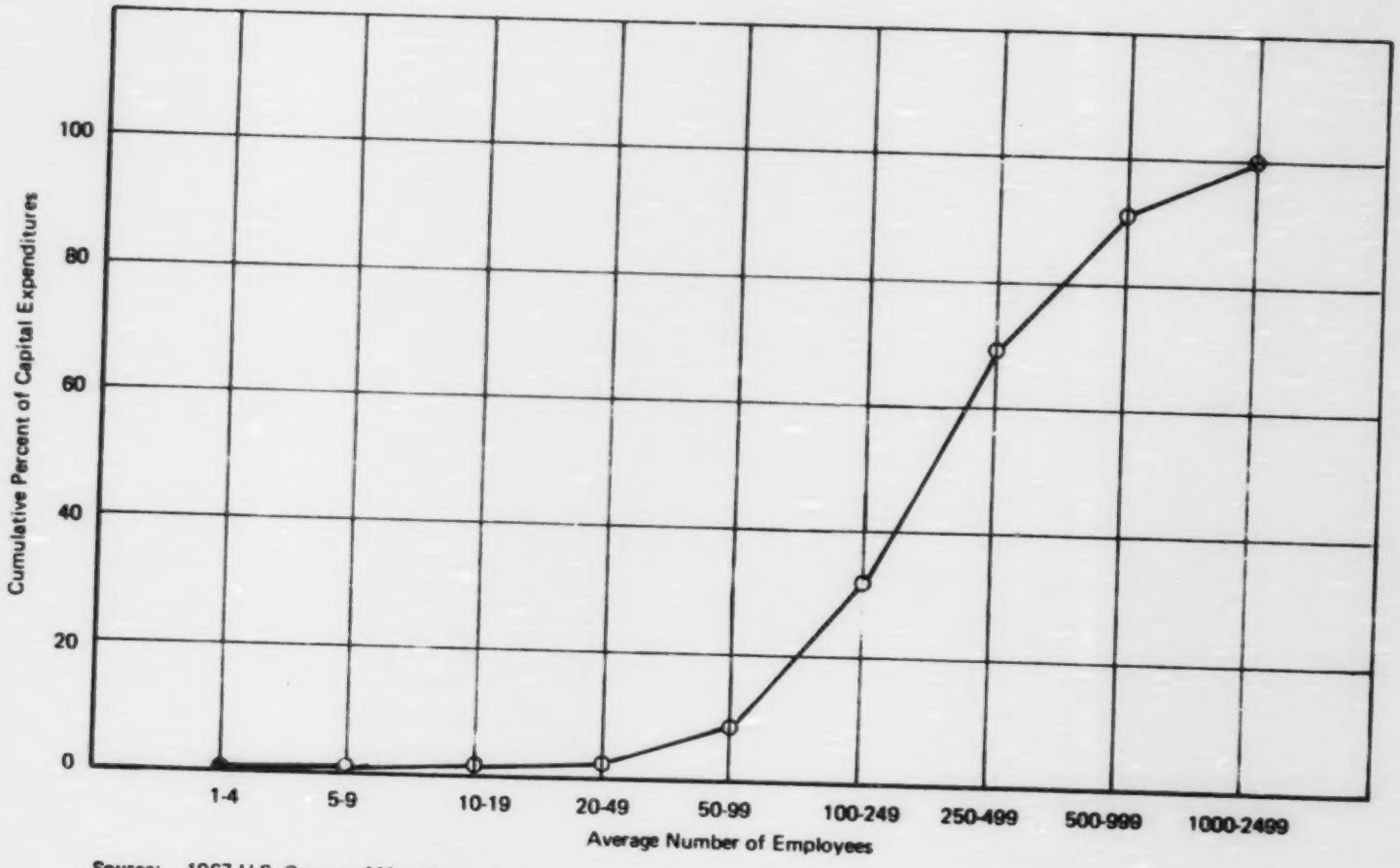
* Contractor's estimates based on capital expenditure per employee equivalent to 1.25 times 1963 Census values

Source: 1967 U. S. Census of Manufacturers



Source: 1967 U.S. Census of Manufactures.

FIGURE 12 THE ASBESTOS MANUFACTURING INDUSTRY – VALUE OF SHIPMENTS AS A FUNCTION OF SIZE OF FACILITIES



Source: 1967 U.S. Census of Manufactures.

FIGURE 13 THE ASBESTOS MANUFACTURING INDUSTRY – THE CAPITAL EXPENDITURES VERSUS PLANT SIZE

in general.

As discussed previously, the products of concern in this study account for over 80 percent of the total value of shipments of SIC 3292. Furthermore, the eight largest firms involved in the manufacture of the subject products currently account for over 80 percent of the value of sales. The distribution of the total sales of these products among these eight largest manufacturers are estimated as follows:

Company	Percent of Total Value of Shipments
Johns Manville Corporation	30-35
Jim Walter Corporation	14-17
Flintkote Company	9-11
Certain-Teed Products Corporation	6-8
Armstrong Cork Company	6-8
GAF Corporation	3-5
National Gypsum	3-5
Nicolet Industries	3-5
Subtotal	80
All Others	20

Since the above companies represent such a high proportion of the value of product shipments, they were chosen for more detailed financial analysis. Tables XV to XVII summarize the salient financial statistics for these companies (where such statistics are available).

COST STRUCTURE

Recognizing that manufacturing costs are very sensitive to, among other factors, capacity utilization, scale of production, degree of mechanization, productivity, etc., -- all of which vary in turn with specific products and plants -- it would be meaningful to synthesize a cost structure for the asbestos products manufacturing industry (S.I.C. 3292) on the basis of Bureau of the Census data for 1971 and generalizations developed by examining financial data for the major companies.

The following definitions are necessary to facilitate understanding of the synthetic costs:

- Materials — Includes the costs of raw materials, supplies, semi-finished goods, fuels, and electric energy.

TABLE XV

SYNTHETIC INCOME STATEMENT AND BALANCE SHEET FOR THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY* (CIRCA 1971)

INCOME STATEMENT

(Value of Shipments: $633MM)

Cost Item	Amount per Dollar Sales	
Materials	$0.46	
Payroll	0.26	
Depreciation	0.03	
General Adm. & Sales	0.13	
Interest & Other Charges	0.03	
Total	$0.91	
Apparent pre-tax profit	$0.09	$ 57MM
Pre-tax return on stockholders' equity		18%

BALANCE SHEET ($MM)

Assets		Liabilities	
Current	252	Current	125
Plant, Equip., Etc.	254	Long Term Debt	64
		Stockholders' Equity	316
	506		506

Source: Contractor's estimates based on Census data and generalized financial data.

*S.I.C. 3292

TABLE XVI

FINANCIAL STATUS OF MAJOR COMPANIES IN THE ASBESTOS PRODUCTS INDUSTRY – 1972

Company	Approx. No. Employees	1972 Sales & Revenues	Net Pre-tax Operating Profit	Cash Flow	Net Working Cap'l (yr. end)	Total Assets	Long-Term Debt (as % of) Equity
		$MM			$ Millions		
Johns-Manville	25,000	796	77.5	81.9	123.9	736	9%
Flintkote	9,300	440	24.0	38.2	91.4	360	31%
Armstrong Cork	22,500	685	78.3	68.8	165.6	511	19%
National Gypsum	15,000	519	55.9	49.4	165.2	455	20%
GAF (Ruberoid)	22,000	768	50.4	52.2	208.3	611	37%
Jim Walter	26,000	885	77.0	65.2	200.7	983	45%
Certain-Teed	8,600	393	43.0	35.2	77.1	273	23%
Nicolet Industries	450	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.

Source: Company and Trade Reports and Contractor's estimates.

Notes: N.A. = Not Available

TABLE XVII

RECENT TRENDS IN MATERIALS AND PAYROLL COSTS FOR THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRIES

Year	Cost (Dollars per Dollar of Sales)		
	Payroll	Materials	Combined
1968	0.236	0.424	0.660
1969	0.258	0.447	0.705
1970	0.257	0.459	0.716
1971	0.252	0.460	0.712

Source: Annual Survey of Manufacturers U.S. Bureau of the Census

- **Payroll** — All forms of compensation such as salaries, wages, commissions, bonuses, etc.

- **Capital Expenditures** — Expenditures of the type chargeable to fixed asset accounts, and for which depreciation charges are normally made.

A review of these definitions indicates that they together incorporate the important manufacturing cost parameters, except certain elements of general administration and sales costs as well as interest payments. These have been estimated in the synthetic costs shown in Table XV. The resulting 9% apparent pre-tax profit margin is roughly comparable to the overall average of companies in Table XVI. (However, it must be borne in mind that these companies produce a variety of products in different industry segments.)

To derive the capital depreciation, the new depreciable capital investment made by the industry from 1957 to 1971 ($278.4 million) has been determined and, to a first approximation, a 15-year straight-line depreciation has been applied.

Also shown in Table XV is a synthetic balance sheet for asbestos products manufacturing. The balance sheet is derived by generalizing industry financial data into the assumption that total assets are about 0.80 times sales, that year-end working capital is typically about 20% of annual sales, that current assets are twice current liabilities, and that debt is 20% of shareholders' equity.

The above figures applied to the Census data indicate a pre-tax return of $57 MM, equivalent to an 18% pre-tax return on equity for the asbestos products manufacturing industry (S.I.C. 3292) circa 1971.

Asbestos products manufacturing may be characterized as a business with relatively low fixed costs and relatively high variable costs: Table XVII shows that materials and supplies in 1971 accounted for nearly 50 percent of the sales dollar. An additional 25 percent is contributed by payroll. The trends in the cost of these items for the period 1968 to 1971 are shown in Table XVII. Payroll cost per unit of sales appears to have remained stable over this time span, presumably due to a combination of higher product prices, reduced manpower requirements, and increased productivity. Materials costs, on the other hand, have increased steadily. As raw materials, utilities, and fuel costs escalate, it can reasonably be expected that the materials cost trend shown in Table XVII will continue, further squeezing the apparent pre-tax profit margin of 9 percent deduced for the industry as a whole. A pretax margin below 9 percent is typically not considered particularly attractive in manufacturing, especially with an indicated pre-tax return on investment below 20%, as in Table XV. If this truly represents the industry average, some product lines and/or plants obviously may be operating at margins well below this figure. Any external pressures that threaten to substantially reduce this margin could then conceivably endanger these segments of the industry.

PART II: ECONOMIC IMPACT ANALYSIS

A. PROPOSED EFFLUENT QUALITY STANDARDS

To carry out the objectives of the Federal Water Pollution Control Act Amendments of 1972, the asbestos products manufacturing industry is required to achieve by July 1, 1977, effluent limitations consistent with the "best practicable" control technology (BPT); and by July 1, 1983, effluent limitations consistent with the "best available" technology. (BAT).

The water effluent quality standards to be attained by that segment of the asbestos products manufacturing industry that constitutes the subject of this study were published in the Federal Register on Tuesday, February 26, 1974. Standards of performance were also prescribed for new sources (NSP Standards) constructed after publication of the applicable regulations. The specific product categories for which effluent guidelines were developed are:

- Asbestos-cement Pipe
- Asbestos-cement Sheet Products
- Asbestos Paper (starch and elastomeric binders)
- Asbestos Millboard
- Asbestos Roofing
- Asbestos Floor Tile

Appendix A shows for each product category the effluent quality that satisfies the BPT and BAT standards. In all cases, zero-discharge is the only standard applicable to BAT. Thus, fresh water taken into plants equals the sum of water incorporated in wet product and any evaporative losses. Among the benefits thus realized is a 100 percent reduction of all pollutant constituents, and where applicable, the chemical oxygen demands. Zero-discharge is also required in new sources except for asbestos-cement pipe and asbestos paper (elastomeric binder) manufacturing where new source standards are identical to the BPT standards.

B. EFFLUENT TREATMENT TECHNOLOGIES

The technologies described below have been advanced in the Guideline Development Document as suitable for meeting the standards set forth in Appendix A.

In all cases, the standards and technologies applicable to new sources -- any sources constructed after January 16, 1974, the publication date of the proposed standards -- at least equal those proposed for BPT levels.

Product Category	Applicable Technologies to Satisfy:		
	BPT Standards	BAT Standards	New Source Standards
Asbestos-cement pipe	Sedimentation and pH control	100% process water recycle	Sedimentation and pH control
Asbestos-cement sheet	Sedimentation and pH control	100% process water recycle	100% process water recycle
Asbestos paper (starch binder)	Sedimentation	100% process water recycle	Sedimentation
Asbestos paper (elastomeric binder)	Sedimentation	100% process water recycle	100% process water recycle
Asbestos millboard	100% process water recycle	100% process water recycle	100% process water recycle
Asbestos roofing	Sedimentation	100% process water recycle	100% process water recycle
Asbestos floor tile	Coagulation and sedimentation	100% process water recycle	100% process water recycle

C. CURRENT LEVELS OF POLLUTION ABATEMENT

To facilitate discussion and understanding of the current state of application of the treatment technologies discussed previously, these have been coded with respect to the various product categories as follows:

Product Category	Code	Explanation
Asbestos-cement pipe	A	No treatment
	B	Sedimentation only
	C (BPT)	Sedimentation and pH control
	D (BAT)	100% recycle
Asbestos-cement sheet	A	No treatment
	B	Sedimentation only
	C (BPT)	Sedimentation and pH control
	D (BAT)	100% recycle
Asbestos Paper	A	No treatment
	B (BPT)	Sedimentation
	C (BAT)	100% recycle
Asbestos Millboard	A	No treatment
	B	Sedimentation
	C (BPT & BAT)	100% recycle
Asbestos Roofing	A	No treatment
	B (BPT)	Sedimentation
	C (BAT)	100% recycle
Asbestos Floor Tile	A	No treatment
	B (BPT)	Coagulation and Sedimentation
	C (BAT)	100% recycle

A survey of the asbestos products manufacturing plants shows, for a cross-section of the industry, the effluent treatment pattern shown in Appendix B. The existing utilization trend may be summarized as follows in terms of the percentages of the total number of plants and the total effluent discharge by each product category.

Product Category	Percentage of Plants Using Treatment Technology Alternatives				Percentage of Discharge Treated by Technology Alternatives			
	A	B	C	D	A	B	C	D
Asbestos-cement Pipe (Total Discharge = 2.99×10^6 gpd)	14	43	29	14	16	43	41	0
Asbestos-cement Sheet (Total Discharge = 1.84×10^6 gpd)	38	38	9	15	41	51	8	0
Asbestos Paper (Total Discharge = 5.3×10^6 gpd)	14	57	29	–	21	79	–	–
Asbestos Millboard (Total Discharge = 1.33×10^6 gpd)	29	43	28	–	38	62	–	–
Asbestos Roofing (Total Discharge = 0.59×10^6 gpd)	56	33	11	–	44	56	–	–
Asbestos Floor Tile (Total Discharge = 1.96×10^6 gpd)	77	23	0	–	61	39	–	–

The above breakdown may be rendered as follows to indicate the percentage of the existing plants that do not currently meet the BPT and BAT effluent quality standards.

Product Category	Percentage of Plants Not Now Meeting	
	BPT Standards	BAT Standards
Asbestos-cement Pipe	57	86
Asbestos-cement Sheet	76	85
Asbestos Paper	14	71
Asbestos Millboard	72	72
Asbestos Roofing	56	89
Asbestos Floor Tile	77	100

It is difficult to arrive at a realistic estimate of the proportion of the total discharge that goes into public sewerage systems. However, for those plants with no treatment facilities whatsoever, (alternative A plants), the following percentages are estimates of the untreated waste flows in each category that go to public sewers:

Asbestos-cement Pipe	-	43%
Asbestos-cement Sheet	-	62%
Asbestos Paper	-	100%
Asbestos Millboard	-	100%
Asbestos Roofing	-	81%
Asbestos Floor Tile	-	84%

D. WATER TREATMENT COSTS

The "typical plant" cost data which constitute the basis for subsequent derivation of the industry water treatment costs and potential economic impact have been developed on the basis of assumptions discussed in the Effluent Guideline Development Document.

For each product category, a typical plant was selected on the basis of a relatively high quality of the treatment facilities, the quantity of wastewater discharged, the ready availability of cost data, and the adequacy of verified information regarding the effectiveness of the treatment facility. Waste flows were selected to reflect the condition at the larger plants for each product category.

Specific applicable control technologies and costs were developed for plants discharging their effluents into navigable waters. It should be borne in mind that factors such as age and size of production plants, level of implementation of in-plant process controls, and specific manufacturing processes and practices would directly affect the quality and quantity of generated effluents and therefore the water treatment costs at a given facility. Thus, it is acknowledged that, in fact, facilities do exist with higher than "typical" water treatment costs. However, the technique of using a "typical" plant as representative of a particular product category does not either reveal such high-cost plants nor does it indicate the size of these higher costs.

Additionally, in developing the costs to various plants in a product category, it is assumed that the only variable that significantly affects costs is the end-of-pipe volume of wastewater discharged to the treatment facility. It is further assumed that the installed control facilities require minimum space and thus no additional land requirement beyond that currently occupied by the manufacturing plant would be involved.

Appendix C shows the production and effluent discharge data of plants considered "typical" of each of the product categories for which treatment costs and technologies were developed.

1: Capital Investment Costs

In the derivation of "typical plant" capital investment costs, the Guidelines Development Document includes all capital expenditures required to bring the treatment or control technology into operation. Included, as appropriate, are the costs of excavation, concrete, mechanical and electrical equipment installed, and piping. In addition, an amount equal to from 15 to 25 percent of the total of the above was added to cover engineering design services, construction supervision, and related costs. Land costs are assumed to be zero.

Table XXI presents the estimated capital investments (in 1971 dollars) for a range of effluent capacities for the asbestos-cement pipe segment of the industry. Using as a basis the capital investment of the typical plant facility, the corresponding investments for other size treatment units within the range evaluated were derived using the "six-tenth rule," defined as follows:

$$\text{Cost of Unit X} = \text{Cost of Typical Unit} \left[\frac{\text{Capacity of Unit X}}{\text{Capacity of Typical Unit}}\right]^{0.6}$$

where X is the unknown treatment facility.

TABLE XVIII

**ASBESTOS-CEMENT PIPE PLANTS:
WATER TREATMENT CAPITAL INVESTMENT AS A
FUNCTION OF TREATMENT CAPACITY**

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) To Satisfy BPT Standards	BAT Standards
100	76,500	116,000
250	133,000	201,000
500*	201,000	305,000
1,000	305,000	462,000
1,500	389,000	590,000

*Typical Plant Capacity

Source: Based on "typical plant" cost contained in the Guidelines Development Document.

Appendices D to H show corresponding capital cost estimates for the other asbestos product categories. The cost figures shown in these tables reflect the costs incurred in attaining any of the specified standards, by facilities that are discharging raw effluent. Thus, a plant that is currently treating its effluent to less than a given standard would incur only the additional cost of upgrading its facility to meet the said standard. To a first approximation, it is assumed that this upgrading cost equals the difference between the costs of attaining the higher and lower levels of treatment.

It should be indicated that the decision as to whether a plant not now meeting the BPT standards should install additional facilities to satisfy only these standards or expend more funds now to meet the BAT standards must be made at the corporate level, taking into account the company's planning strategy and financial position. Where funds are readily available and where corporate policy justifies it, it may be advantageous to upgrade in one step to the BAT standards. In other instances, corporate wisdom may dictate distributing the costs over a time span stretching to 1983.

2: Annual Treatment Costs

The annual water treatment cost is comprised of the costs of capital, depreciation, operation and maintenance, and energy and power.

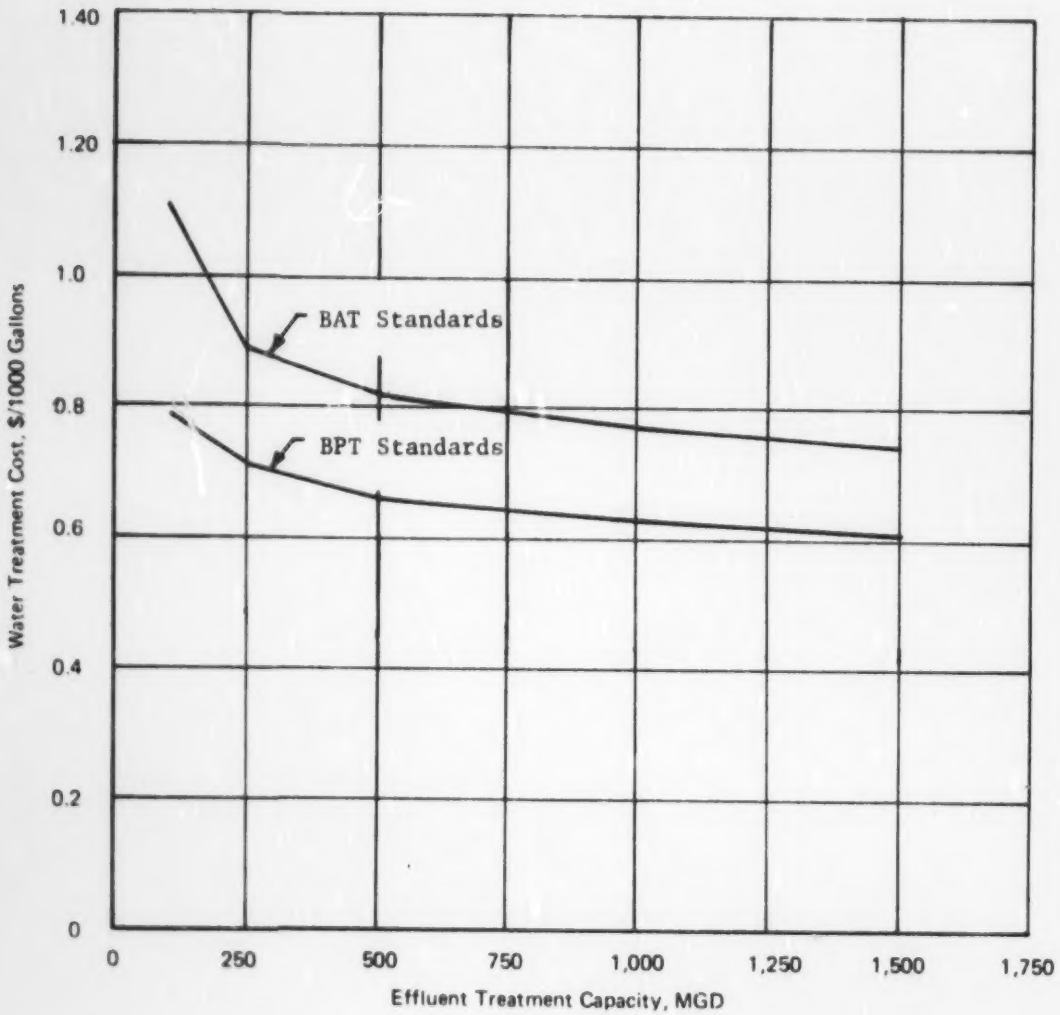
Capital cost is taken, in all cases, as 8 percent of the capital investment, a figure which is considered reasonably accurate for the industry. Depreciation is taken on a straight line basis for 20 years, or 5 percent of the total investment.

Operation and maintenance costs include labor, materials (including chemicals), solid waste disposal, effluent monitoring, added administrative expense, taxes, and insurance. Due credit was applied in technologies involving water recycling. Power costs are based on a rate of $0.025 per kilowatt/hour.

The annual treatment costs are shown in Appendices I to N for ranges of effluent treatment capacities for the various product categories. In the absence of detailed cost breakdown, the operation and maintenance and energy and power costs are assumed to vary directly with the treatment capacity, using as a basis the costs of the so-called typical plant. The variation of treatment cost as a function of capacity is shown graphically in Figures 14 to 19 for the product categories of interest.

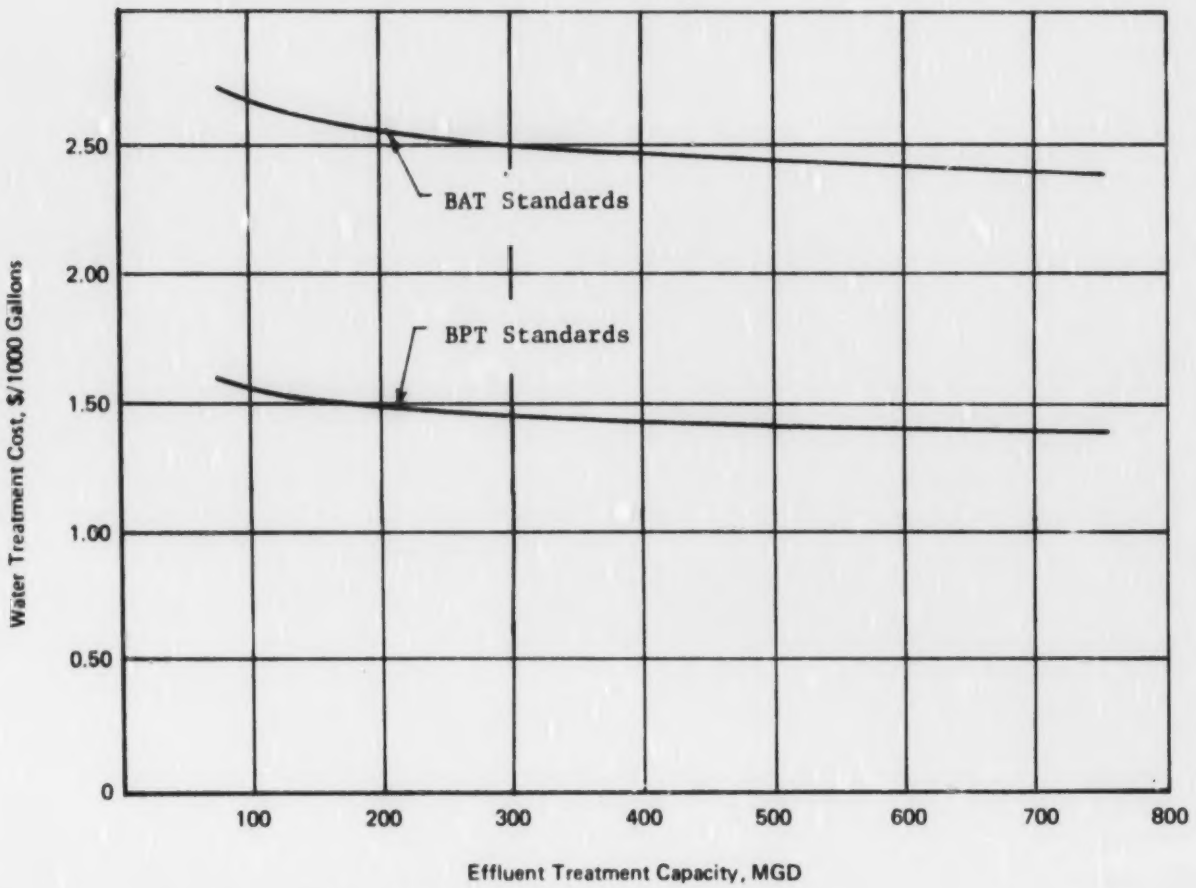
3: Specific Plant Costs and Projected Industry Costs

On the basis of the projected capital and annual treatment costs shown in Appendices D to N and knowing the treatment technologies currently being practiced by the surveyed cross-section of the industry as shown in Appendix B, estimates have been made, for each plant in the sampling, of its incurred capital and annual costs to bring its effluents



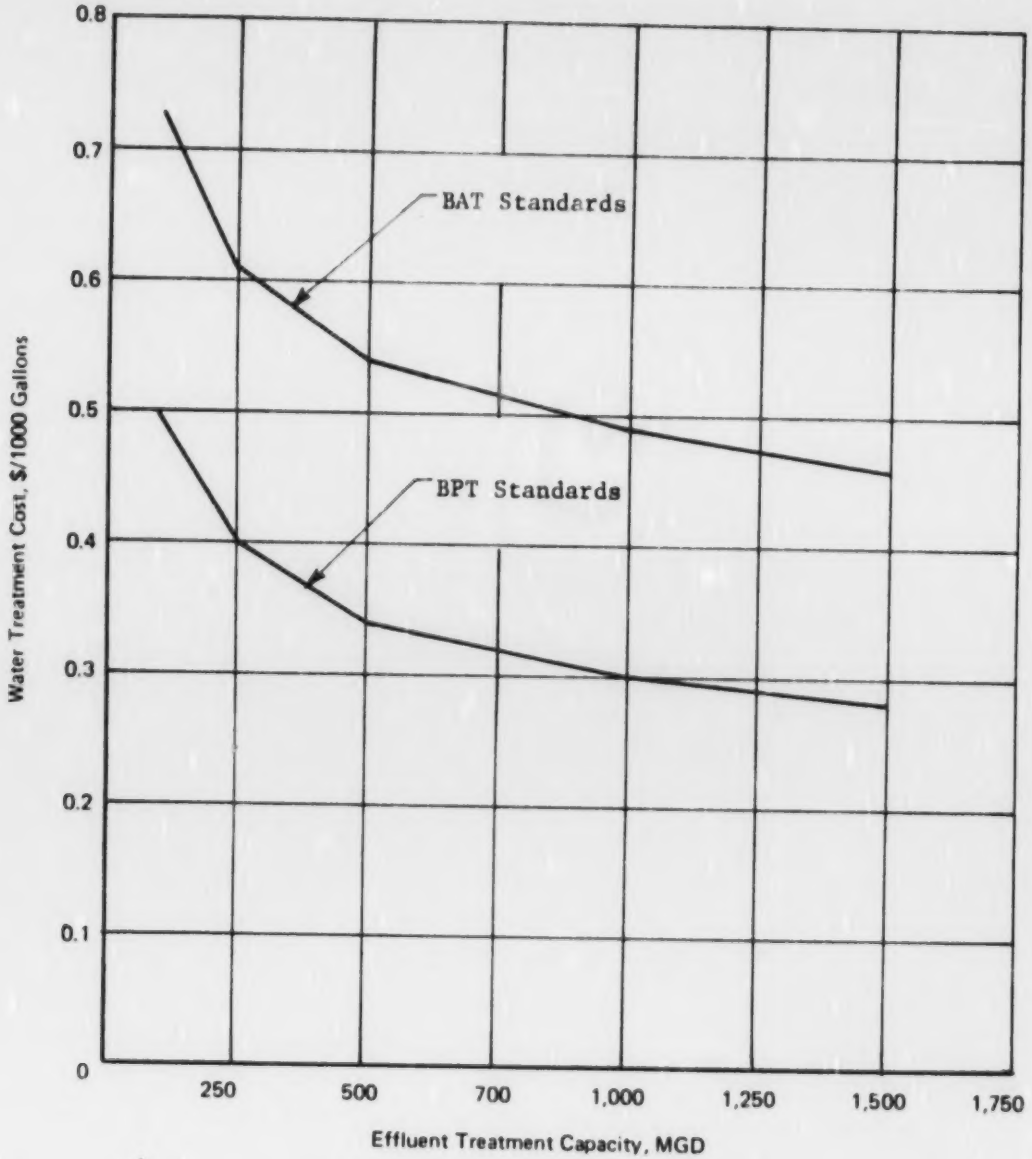
Source: Based on "typical plant "costs in Guidelines Development Document

FIGURE 14 ASBESTOS-CEMENT PIPE PLANT: WATER TREATMENT COST VERSUS EFFLUENT TREATMENT CAPACITY



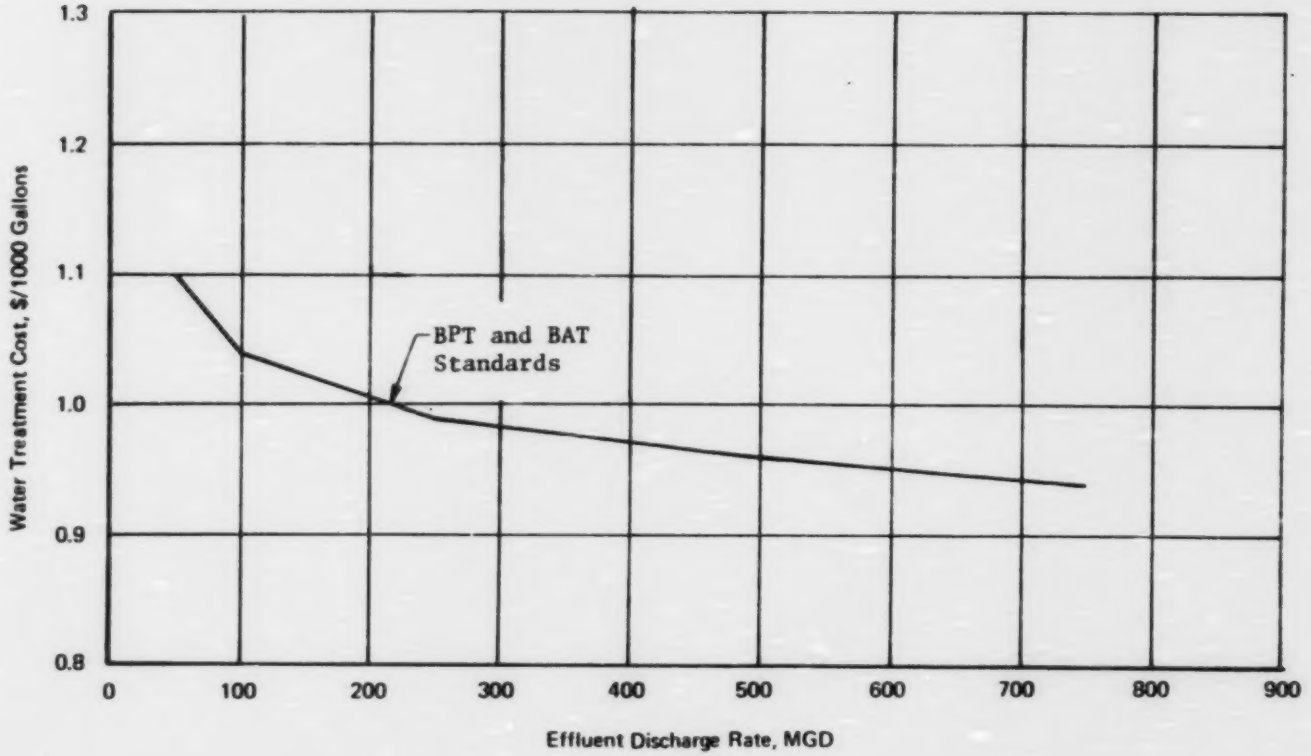
Source: Based on "typical plant" costs in Guidelines Development Document

FIGURE 15 ASBESTOS-CEMENT SHEET PLANT: EFFLUENT TREATMENT COSTS AS A FUNCTION OF EFFLUENT TREATMENT CAPACITY



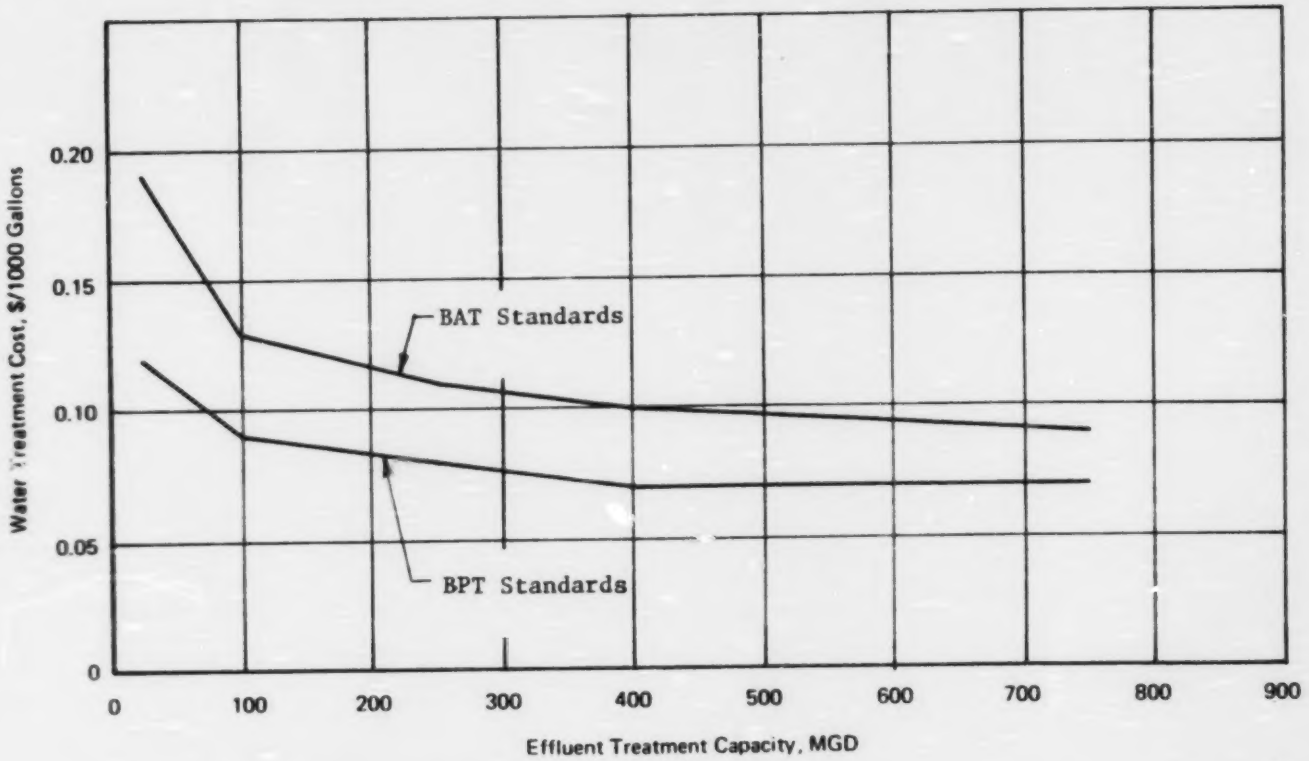
Source: Based on "typical plant" costs in Guidelines Development Document

FIGURE 16 ASBESTOS PAPER PLANT: WATER TREATMENT COST AS A FUNCTION OF EFFLUENT TREATMENT CAPACITY



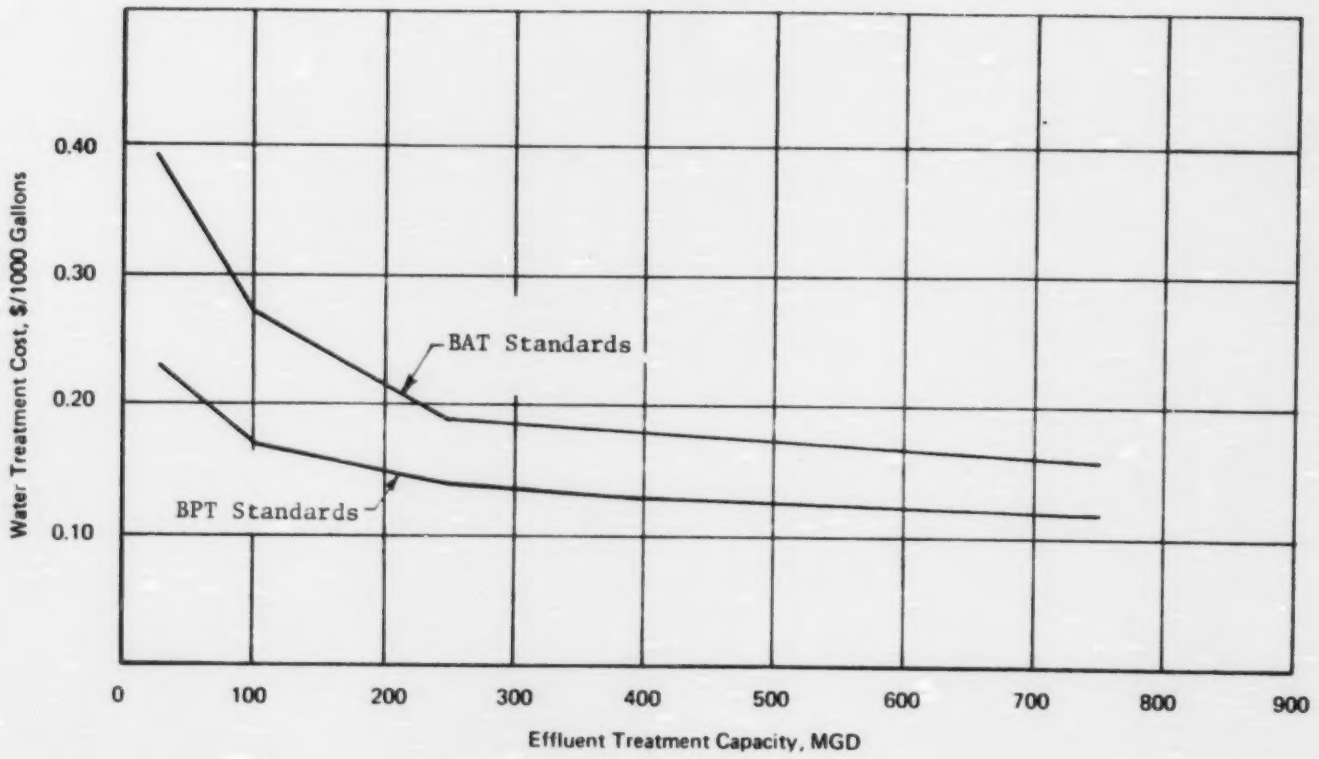
Source: Based on "typical plant" costs in Guidelines Development Document

FIGURE 17 ASBESTOS MILLBOARD PLANT: WATER TREATMENT COST VERSUS EFFLUENT TREATMENT CAPACITY



Source: Based on "typical plant" costs in Guidelines Development Document

FIGURE 18 ASBESTOS ROOFING PLANT: WATER TREATMENT COSTS VERSUS EFFLUENT TREATMENT CAPACITY



Source: Based on "typical plant" costs in Guidelines Development Document

FIGURE 19 VINYL-ASBESTOS TILE PLANT: WATER TREATMENT COSTS VS. EFFLUENT TREATMENT CAPACITY

in compliance with the BPT and BAT standards. These are shown respectively in Appendices O and P. Each plant's costs are based, where data are available, on its actual reported effluent discharge rate. In a few instances where effluent statistics are not available, it has been assumed that the costs are equivalent to those of the "typical plant" described in the Effluent Guidelines Development Document, as defined previously.

After a careful review of the list of plants producing each product of interest, as well as discussions with informed members of the asbestos manufacturing community, it is believed that the listed plants account for the following proportions of the current total shipments of each of the products evaluated:

Asbestos-cement Pipe	-	95-100%
Asbestos-cement Sheet	-	90-95%
Asbestos Paper	-	95-100%
Asbestos Millboard	-	95-100%
Asbestos Roofing	-	95-100%
Asbestos Floor Tile	-	60-70%

The capital investment and the annual water treatment costs derived in Appendices O & P may be aggregated and scaled-up to indicate the total costs to each industry segment of meeting the BPT and BAT standards. These aggregates are shown in Tables XXII and XXIII. Thus, the manufacturers of the products studied can anticipate a total capital investment of about $3 million and an annual cost of $1.4 million to bring their facilities in compliance with the BPT guidelines. To meet the BAT standards, the capital investment and annual costs would escalate to $6.5 million and $2.9 million respectively.

For purposes of subsequent assessment of the corporate financial impact of these expenditures on individual companies, these costs have been assembled for all the product lines of the various plants of the major asbestos products manufacturing companies. These are shown in Table XXIV.

Individual companies can anticipate capital investments ranging from $60,000 to $731,000 to bring their facilities in compliance with the BPT standards, and from $144,000 to $1.5 million to satisfy the BAT standards. As for annual costs, these range from a low of $24,000 to a high of $336,000 to achieve the BPT standards, and from $98,000 to $776,000 to meet the BAT guidelines.

It is instructive to express these capital expenditures for effluent treatment in terms of the minimum annual capital outlays of each of the

TABLE XIX

ESTIMATED TOTAL COSTS TO THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY OF MEETING THE BPT WATER EFFLUENT STANDARDS

Product Category	Costs Incurred by Listed Plants ($)		Costs Incurred by Total Industry ($)	
	Capital	Annual	Capital	Annual
Asbestos-cement Pipe	666,000	327,500	700,000	345,000
Asbestos-cement Sheet	622,000	424,900	655,000	472,000
Asbestos Paper	617,000	180,600	650,000	190,000
Asbestos Millboard	140,000	85,900	147,000	90,000
Asbestos Roofing	98,000	44,600	103,000	47,000
Asbestos Floor Tile	404,000	147,100	673,000	245,000
Total			$2,928,000	$1,389,000

TABLE XX

ESTIMATED TOTAL COSTS TO THE ASBESTOS PRODUCTS MANUFACTURING INDUSTRY OF MEETING THE BAT WATER EFFLUENT STANDARDS

Product Category	Costs Incurred by Listed Plants ($)		Costs Incurred by Total Industry ($)	
	Capital	Annual	Capital	Annual
Asbestos-cement Pipe	1,585,000	573,500	1,668,000	604,000
Asbestos-cement Sheet	1,291,000	1,036,900	1,434,000	1,152,000
Asbestos Paper	1,190,000	582,800	1,253,000	614,000
Asbestos Millboard	140,000	85,900	147,000	90,000
Asbestos Roofing	243,000	65,900	256,000	69,000
Asbestos Floor Tile	1,051,000	214,300	1,752,000	357,000
Total			$6,510,000	$2,886,000

TABLE XXI

WATER TREATMENT COSTS, BY COMPANIES, TO MEET THE BPT AND BAT EFFLUENT STANDARDS

Company Code	Capital Investment ($)	Annual Cost ($)
BPT Standards		
AA	560,000	336,000
BB	390,000	199,100
CC	731,000	308,800
DD	156,000	58,800
EE	174,000	44,200
FF	60,000	24,400
GG	237,000	62,100
HH	157,000	110,300
BAT Standards		
AA	1,503,000	776,600
BB	665,000	262,100
CC	1,343,000	775,700
DD	435,000	110,800
EE	395,000	138,000
FF	144,000	162,000
GG	294,000	98,200
HH	256,000	189,400

firms. These ratios are shown in Table XXV, indicating that the new water treatment capital investments required to comply with the BPT and BAT treatment levels constitute in general only about 1 percent of the normal annual capital investment (in all product lines) of these firms.

E. ECONOMIC IMPACT ANALYSIS

1. Methodology

The purpose of the detailed cost analysis conducted above is to provide the essential basis for arriving at realistic conclusions regarding the specific impacts of incurred water treatment costs. The specific economic parameters that are vulnerable to impact, and which are to be evaluated within the scope of this study are:

i. Product price effects

ii. Financial effects

iii. Production effects

iv. Employment effects

v. Community effects

vi. Balance of payment effects

TABLE XXII

NEW WATER TREATMENT COSTS (BY MAJOR ASBESTOS PRODUCTS MANUFACTURING FIRMS) AS A PROPORTION OF ANNUAL CAPITAL EXPENDITURES

Company Code	Estimated Minimum Annual Capital Expenditure (10^6)	New Water Treatment Costs			
		BPT Standards[1]		BAT Standards[2]	
		Amount (10^6)	% of Total Cap. Exp.	Amount (10^6)	% of Total Cap. Exp.
AA	65	0.295	0.5	0.525	0.8
BB	13	0.205	1.6	0.231	1.8
CC	29	0.383	1.3	0.469	1.6
DD	30	0.084	0.3	0.154	0.5
EE	45	0.090	0.2	0.140	0.3
FF	0.75-2.0	0.03	1.5-4.0	0.05	2.5
GG	20	0.126	0.6	0.102	0.5
HH	14	0.084	0.6	0.091	0.7

NOTES:

1. Dollar investment is assumed to be funded over a period of two years (1975 and 1976).
2. Funding assumed to be funded over 3 years.

Source: Company Annual Reports and Contractor's Estimates.

It is concluded that whereas certain of these parameters must be evaluated on a plant-by-plant basis (e.g. community effects), others are more meaningfully assessed on a corporate basis (e.g. financial effects), while still others must necessarily be analyzed on an industry-wide basis (e.g. product price, production, and employment effects). This approach has the advantage of recognizing disparities due to geographical location, corporate organization, and the market climate of specific product categories.

After carefully evaluating several alternative parameters that can be applied as a measure of economic impact on specific plants, it is felt that the most meaningful approach for the group of industries studied would be to relate the added annual cost of water treatment required to comply with a specific standard to the value of sales of a given product at each

plant. It should be recalled that the prior analysis of the cost structure of the asbestos products manufacturing industry, Part I, based on aggregate statistics from the U.S. Bureau of the Census, indicated an apparent pre-tax profit margin of about 9 percent of sales. On the strength of discussions with persons involved in and knowledgeable of the asbestos products manufacturing industry, it is reasoned that this figure can be justifiably applied to the product categories under study. These discussions also lead to the conclusion that water treatment costs amounting to more than about 4.5% of sales would make continued operation of a product line or plant very unattractive. Thus, the subsequent assessment of the sensitivity of a product line or plant to the added water treatment costs, and in turn its probability of discontinuing operations, is based on how closely these costs approach or exceed 4.5% of sales. A new water treatment cost in relation to sales of 4.5% or higher is an indication that a plant or product line is vulnerable.

2. Impact of the BPT Standards

a. Price Effects

The price of a manufactured product is dictated to a large degree by such economic determinants as manufacturing cost and its variation among various producers of the same product, demand/supply balance, and price/performance balance vis-a-vis competitive substitute materials and imports. The prices of the product categories that form the subject of this study are liable to be impacted differently by these various considerations and therefore deserve independent evaluations.

Asbestos-cement Pipe. This product is used principally for water-distribution systems (high-pressure pipe) and for sewer systems (low-pressure pipe). In the former application, it competes with steel, cast iron, plastics and concrete; in the latter, it competes with vitrified clay, concrete, and some cast iron, where it is used as conduit for telephone or electrical wiring. Asbestos cement is one of the least costly pipe materials, being only more expensive than locally produced concrete pipe. This factor should help to retard the penetration of other pipe products into the existing markets for asbestos cement pipe. There is also the added fact of considerable inertia to change on the part of the civil engineering and construction professions. Thus, the modest growth rate of perhaps 5 to 7 percent per year recently experienced by this product should continue for the next five to ten years.

While the output of asbestos-cement pipe has shown a general upward trend in recent years, the Chemical and Engineering News quoted price for the most popular types and sizes of pipe has remained about stagnant, as shown in Table XXVI. Apparently, the increased cost of raw materials, supplies, labor, and other manufacturing cost items in the past 5 to 10 years has not been passed on to the consumer. On the one hand, this may be a reflection of process and practice improvements which have resulted in increased productivity and lower unit manufacturing costs. On the other, it may be an indication of a realization, on the part of

TABLE XXIII

C&EN QUOTED PRICE TREND FOR 6-INCH AND 12-INCH ASBESTOS-CEMENT PIPE (CARLOAD LOTS)

Date	Pipe Diameter (Inches)*	Quoted Delivered Price ($)	
		Los Angeles	New Orleans
January 1966	6	1.40 per ft.	1.30 per ft.
	12	2.19	2.19
January 1968	6	1.60	1.54
	12	1.96	1.96
January 1970	6	1.39	1.31
	12	2.06	2.06
June 1973**	6	1.38	1.35
	12	2.10	2.10

*6-inch municipal water pipe; 12-inch sewer pipe

**Contractor's Estimates

Source: C&EN

asbestos-cement pipe producers, of the rather tenuous price/performance position of asbestos-cement pipe relative to the competing substitute materials discussed previously.

Another worthwhile consideration to keep in mind in attempting to forecast price trends in the asbestos-cement pipe and other asbestos-based product markets is the role of the largest manufacturer. Specifically for asbestos-cement pipe, it is estimated that at least 50 percent of the sales are attributable to Johns-Manville Corporation, which operates a number of large multi-product plants. It is thus in a position to benefit from the economics of scale and common facilities, and, because of its dominant posture, would be expected to become the price trend-setter in its product and/or market areas.

Partly off-setting this factor is the fact that asbestos products plants tend to serve restricted regional markets. Thus it is possible for prices to be passed-on or frozen regionally, irrespective of the decisions of the so-called trend-setter whose plants are located outside the region in question. The analysis herein is not sufficiently specific or detailed to determine the precise action that probably would be taken by each individual producing plant.

In light of the above considerations, along with the fact that the asbestos-cement manufacturing industry's additional annual costs for

meeting the BPT water standards amount to only 0.2 percent of estimated 1972 sales ($345,000 versus $156 million), Table XXII, it is believed that these additional costs would not, of themselves, result in a significant industry-wide increase in prices. Smaller producers in certain regional markets may be able to pass-on their water treatment costs, but even in such cases, the resultant price increase would be insignificant, amounting to only about 1 percent.

Asbestos-cement Sheet. Asbestos-cement sheet refers to a broad family of corrugated and flat board products used in the construction industry for roofing and siding. This family of products, in many respects, has similar properties and market acceptance to the pipe products. It competes principally with masonry, galvanized steel and aluminum, plastics, wood, and asphalt. However, it is generally more expensive than corrugated steel, competitive with aluminum sheets, and less expensive than conventional concrete blocks and built-up roofing.

In the United States, asbestos-cement sheets are used principally for industrial buildings (particularly fertilizer plants and other applications where corrosion is a problem), warehouses, and in similar cost-sensitive markets. It is also used to a limited degree as a siding in the residential market.

In recent years, the growth of the market for asbestos-cement sheets in the United States has lagged behind that of the construction industry in general, amounting to only a few percent per year. It is expected that only minimal growth in the next five to ten years would occur. Achieving a higher than nominal growth would be predicated on the level of effort exerted to exploit the market potential for this product in the developing nations of Africa, Asia, and South America, since these are still cost-sensitive markets where high volumes of building, particularly housing, are expected in the years ahead.

A stagnant market for sheet products is hardly conducive to price increases. Accordingly, it is not expected that a price rise as a result of the additional costs of meeting the BPT effluent standards would occur. Even if such costs were passed on, they amount to a price increase of about 0.5 percent of sales, and this is regarded as insignificant.

Asbestos Paper, Millboard, and Roofing. Of these products, the related products, paper and roofing command markets that are large enough to deserve attention. Asbestos paper is used for flooring underlay, pipeline felt, roofing, gaskets, and electrical insulation. These applications represent growing markets and this trend is expected to continue. Insulating applications may represent an exception since a number of synthetic materials may erode the market for electrical paper.

The costs incurred by asbestos paper, millboard, and roofing manufacturers to meet the BPT effluent standards amount to 0.2%, 1%, and 0.8% respectively of their sales of these products. Accordingly, one may justifiably conclude that these costs can be absorbed by the

manufacturers. Even if they are passed on to the consumer, the resulting price increase will not significantly alter the market growth rate of these products.

Asbestos Floor Tile. The asbestos floor tile market has been less than spectacular in recent years as a result of strong competitive pressures from such products as carpeting and sheet goods (e.g. linoleum). This pressure is expected to intensify in the future and should serve as a damper on price increases. Specifically, the additional cost of water treatment to bring facilities in compliance with the BPT effluent guidelines is estimated at about 0.1% of 1972 sales. This is insignificant and whether or not it is passed on should not in any way affect the market situation of asbestos floor tiles vis-a-vis competitive substitute products.

b. Financial Effects

As indicated earlier, it appears most meaningful to discuss the financial impact of water treatment costs on a company-by-company basis. Thus, the estimated capital investment and annualized costs as given previously on a plant-by-plant basis have been aggregated to derive a sum total for each of the eight major asbestos products manufacturing companies. These firms represent the major producers of the asbestos products of interest, and it is estimated that they account for about 80% of the sales value. The data for the individual companies are presented in Table XXVII.

TABLE XXIV

WATER TREATMENT COSTS TO MEET PROPOSED STANDARDS IN ASBESTOS PRODUCTS MANUFACTURING*

Company Code	Capital Investment		Capital Charge + O&M Annualized	
	BPT	BAT	BPT	BAT
	$MM		$MM	
AA	0.56	1.50	0.34	0.78
BB	0.39	0.66	0.20	0.26
CC	0.73	1.34	0.31	0.78
DD	0.16	0.44	0.06	0.11
EE	0.17	0.40	0.04	0.14
FF	0.06	0.144	0.024	0.162
GG	0.24	0.29	0.06	0.10
HH	0.16	0.26	0.11	0.19

*Unadjusted basis – 1971 constant dollars.

Source: Contractor's estimates

Profitability Effects. Before using the data in Table XXVII which are in constant 1971 dollars, it should be emphasized that the financial impact as seen by any individual company will be measured in terms of current dollars, i.e., as an increase in cost of operations and capital investment measured in the same dollars as the company's financial results to be reported in a future accounting period. To a good approximation, the impact in 1972 dollars may be synthesized by inflating the data in Table XXVII by 5% and relating the resultant figures to the reported sales and operating profits of these companies for 1972. This is shown in Table XXVIII. On the assumption that these water treatment costs expressed in 1972 dollars inflate to 1977 dollars at about the same rate as asbestos products sales, then the ratios of Table XXVIII will remain relatively stable. However, even if there is some upward shift, the important point is that they are so close to zero as to be well within the limits of the companies' assumed ability to predict year-to-year variations in sales or profit margin.

TABLE XXV

FINANCIAL IMPACT OF THE BPT STANDARDS ON THE MAJOR ASBESTOS PRODUCTS MANUFACTURING COMPANIES

Company Code	"Annualized" Costs of Treatment (in 1972 Dollars)[1] ($MM)	Percent 1972 Total Co. Sales (%)	Percent of 1972 Total Oper. Profit Before Taxes (%)	"Annualized" Costs of Treatment – 1972 Dollars-Expressed in Terms of Asbestos Operations Only[2] % of Sales
AA	0.357	nil	0.5	nil
BB	0.210	nil	0.5	nil
CC	0.326	nil	0.6	nil
DD	0.063	nil	nil	nil
EE	0.042	nil[3]	nil[3]	nil[3]
FF	0.025	nil	1.1E	nil
GG	0.063	nil	nil	nil
HH	0.116	nil	nil	nil

NOTES:

1. Table 6 data (1971 dollars) inflated 5%.
2. That is, dividing Column 2 by estimated asbestos products sales only.
3. Denotes a figure below 0.5%

E = Estimated

Source: Contractors estimates; company annual reports.

In the last column of Table XXVIII, to estimate the impact of water treatment costs -- not on a company's total sales, but only on its asbestos products sales -- these costs have been divided by an estimate of the aggregate value of each company's 1972 sales of asbestos products of interest. The calculation in all cases gave a result of under 0.5% of sales. The actual figures are subject to considerable variation, depending on actual production levels, transfer prices, and net shipments to market. However, it is felt that the results presented give a reasonably good picture of the order of magnitude of the cost impact-in all cases it appears to be less than 0.5% of sales.

Capital Availability. The range of estimated capital investment requirements to meet the BPT standards is $0.16 to 0.73 million. This may be put in the perspective of each company's operation as previously shown in Table XXV, relating these amounts to each company's level of total capital spending.

In Table XXV, estimates have been made of the minimum annual levels of capital expenditures over the near term for each of the companies studied, based on the recent pattern as reported by each company. To keep the comparisons on a consistent basis, these minimum assumed levels are expressed in constant 1972 dollars. The dollar investment requirements for water treatment, also exp essed in constant 1972 dollars, were obtained from the values in Table XXVII inflated 5%. For comparison with each company's minimum level of total capital expenditures, one may assume that the amounts to be spent on water treatment will be spread over two years (i.e., 1975 and 1976) to meet the BPT standards, and the amounts required to meet the BAT standards will be funded over a three-year period.

It is clear from the table that the burden imposed by such capital investment requirements is not of large proportions when viewed in this light.

c. Production Effects

Appendices Q to V represent a plant-by-plant compilation, for each product category, of the water treatment costs required to comply with the BPT standards as a percentage of the estimated 1972 sales.

Asbestos-cement Pipe (App. Q). Of the 14 plants tabulated, only eight would incur any expenses to bring their present treatment facilities in compliance with the BPT standards. As a percent of sales, these expenses range from 0.02 to 1.3%. As such, it is not expected that any of these plants would be liable to adverse production impact as a result of the added cost of meeting the BPT effluent guidelines.

Asbestos-cement Sheet (App. R). All but 3 of the 13 plants surveyed would incur annual expenses, ranging from 0.05% to 4.1% of sales, to meet the BPT standards. Potentially, the maximum impact would be experienced by SS-3, a very small plant with about $1 million in sales, located in

the Southern United States or Puerto Rico.

Asbestos Paper (App. S). Only two plants, out of 12, will be required to up-grade their facilities to meet the BPT standards. For these, the expenditures amount to 1.44% and 0.75% of sales, and they are thus not considered economically sensitive to the additional costs of upgrading these facilities.

Asbestos Millboard (App. T). The effluent standards for the asbestos millboard segment of the industry are identical for BPT and BAT levels of treatment. This may be considered a disadvantage by the industry since the period over which the costs of meeting the BAT standards may be spread is correspondingly reduced. For this segment alone, therefore, the two plants whose added water treatment costs amount respectively to 4.9% and 3.5% of their annual sales are considered as being relatively sensitive to the BPT standards. EM-1 is a small facility located in the Eastern United States with annual millboard sales of about $0.8 million. Similarly, EM-3, a slightly larger facility with annual sales of $1.1 million, is located in the Eastern United States.

Asbestos Roofing (App. U). As indicated previously, asbestos roofing constitutes a very small fraction (perhaps less than 2%) of the total roofing market. Thus, asbestos roofing may be considered a "specialty" product. Appendix U shows that for those facilities whose effluents do not currently meet the BPT guidelines, the annual expense of upgrading these facilities ranges from 0.4 to 2.3% of sales. These product lines are not considered vulnerable to shutdown or production curtailment by reason of these added costs.

Asbestos Floor Tile (App. V). It can be stated that, for this product category, the annual water treatment costs for meeting the BPT guidelines are insignificantly small in comparison to annual sales, ranging up to 0.24% in the worst case. Thus, no plants are considered sensitive to these additional costs.

In summary, therefore, these analyses have identified the following plants or product lines as being potentially vulnerable as a result of the BPT effluent guidelines:

Plant Code	Product	Location	Annual Sales of Product (10^6)	Additional Annual Water Treatment Cost
SS-3	Sheet	Southern U.S.*	1.0	$40,900
EM-1	Millboard	Eastern U.S.**	0.77	38,000
EM-3	Millboard	Eastern U.S.**	1.1	38,000

*Alabama, Arkansas, Florida, Georgia, Louisiana, Mississippi, Texas, Puerto Rico

**Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania

It may be observed that these are relatively small plants or product lines. As such, all other things being equal, the potential impact on the national markets for their specific product lines, as a result of these plants curtailing or ceasing production, is expected to be minimal. It may be observed parenthetically that the apparent and potential production loss represented by the closure of these plants should not translate into increased imports of these products. Ordinarily, other domestic producers (now operating at about 70 percent of capacity) would be expected to take up this relatively small slack in supply. Furthermore, it is unlikely that foreign producers, in light of the relatively high freight rates involved, would be attracted by such low-value products.

d. Employment Effects

According to the U.S. Bureau of the Census, the asbestos products manufacturing industry (SIC 3292), which includes asbestos-cement products, roofing, textiles, floor tile, and friction materials, in 1971 employed a work-force of 18,900, a decrease of 19 percent from the 1969 total.

It is believed that the attrition in the number of employees is continuing at a reduced rate, and therefore 1973 employment is estimated at about 17,000. The product lines under study - asbestos-cement pipe and sheet, asbestos paper, roofing, and millboard, and asbestos floor tile - probably account for 80 percent of the total workforce, or 13,600 employees.

The three plants or product lines previously identified as potentially vulnerable employ a total workforce estimated at about 270, equivalent to about 2 percent of the total employment of the product categories studied. Accordingly, it may be concluded that the impact of the BPT effluent standards, in terms of employment reduction, is minimal for the industry as a whole.

e. Community Effects

As discussed previously, the sheet plant identified as potentially sensitive to the costs of meeting the BPT guidelines is located in the Southern region of the United States (which includes Puerto Rico). The Manpower Administration of the United States Department of Labor has, as of June 1, 1973, classified the municipality in which this plant is located as an area of "substantial unemployment."* Its unemployment rate is 20 percent, an increase from 17 percent in March 1972. It may thus be concluded that, in this case, closing of the sheet plant would aggravate an already serious local unemployment situation. Furthermore, because there is only a limited number of other manufacturing activities in the immediate vicinity of the sheet plant, we believe dislocated workers will not readily obtain other employment here in the short-run. Admittedly,

*A labor area in which the current and anticipated local labor supply substantially exceeds labor requirements. An area is placed in this category when (1) unemployment equals or exceeds 6% of its work force and (2) it is anticipated that the rate of unemployment during the next two months will remain at 6% or more.

closure of this plant will result in undesirable personal impact on the laid-off workers, but in terms of the entire community, it is not expected that the event of closure will exert any significant impact.

The impact-sensitive millboard plant, EM-1, is located in one of the industrial Eastern states. However, the area in which it is located has, in the last decade, witnessed a massive erosion of its industrial base, largely the result of imports and the perfection of man-made substitutes for the major products manufactured. The area is accordingly classified as one of "persistent unemployment,"** its March 1973 unemployment rate being 10.4%. Furthermore, the prospects for new industry in the area are not bright. In January 1973, the total non-agricultural employment in the immediate area around the plant was reported as 133,000. Again, one must conclude that the possible addition of workers dislocated from the millboard plant to the unemployment roster of about 13,000 would not generate noticeable community impact.

The second millboard plant liable to impact, EM-3, is also located in an Eastern U.S. industrial state. Its labor area has a moderate unemployment rate (4.2%). Furthermore, there is a concentration of manufacturing and service industries which could absorb dislocated employees, and no net loss of industry is anticipated in the next five years. Accordingly, the community impact due to the possible closure of this facility would be considered minimal.

f. Balance of Payments Effects

Table XXIX depicts the recent trends in the values of U.S. exports and imports of manufactured asbestos products, including the products covered by this study. Clearly, the trend has been in favor of the United States, and this favorable balance should continue in the future. In fact, there is reason to believe that if it so desires, the U.S. asbestos products industry may advantageously participate in the growth of consumption of asbestos-based products forecast for the balance of this century in the developing nations of the world. For instance, the market for sewer and water-distribution systems is considered to be attractive in these countries, many of which have no basic sewer and water systems and, as their economies develop, and as they obtain financial support from international agencies such as the United Nations and the World Bank, the demand should continue to grow for large-diameter pipes for both sewer and water systems. Similar comments may be made regarding the future demand in these countries for sheet, roofing, paper, and tiles.

The implementation of the BPT effluent standards, by itself, should not alter the validity of the above observations. One may therefore project a very favorable trade balance on asbestos products, regardless of any price effects due to these standards.

**Generally indicative of an average unemployment rate of at least 50% above the national average for at least 1 of the preceding 2 calendar years.

Partly moderating the optimism implied above is the recent trend in the value of manufactured asbestos product imports as shown in Table XXIX. It has increased from $8.8 million in 1969 to $11.3 million in 1972, and it is expected that this trend will continue as such other asbestos products sources as Europe, Japan, and Mexico seek to keep their trade with the U.S. in balance by shipping asbestos-cement pipes, textiles and other asbestos articles into the United States. Another inducement is the increasing popularity of low "back-haul" rates charged by freighters returning to the U.S. after delivering more valuable materials to European and Japanese markets.

TABLE XXVI

RECENT TRENDS IN VALUE OF U.S. EXPORTS AND IMPORTS OF MANUFACTURED ASBESTOS PRODUCTS

Year	Value (10^6) Of	
	Exports	Imports
1969	28.2	8.82
1970	25.3	10.71
1971	31.4	10.93
1972	32.1	11.32

Source: U. S. Bureau of the Census

3. Impact of the BAT Standards

a. Price Effects

A general discussion of the factors governing the price of asbestos products has been presented in a previous chapter. It may be reiterated that any decision to raise the price of a product must be cognizant of supply/demand factors as well as the risk of exposing the market to penetration by substitute products and exports.

Appendices T, and W to AA show that the average annual costs incurred by various product categories to meet the BAT standards, expressed as a percentage of estimated annual sales of each product are as follows:

Asbestos-cement Pipe - 0.37%

Asbestos-cement Sheet - 1.0%

Asbestos Paper - 0.6%

Asbestos Millboard - 1.0%

Asbestos Roofing - 1.1%

Asbestos Floor Tile - 0.1%

These costs are small enough to be absorbable in the short run. As such, it is not anticipated that implementation of the BAT standards would, of themselves, result in a noticeable increase in the price of the above products.

b. Financial Effects

Profitability. Based on the data in Table XXVII certain companies will see sharply higher water treatment costs under the 1983 standards.

For the BAT impact, the contractor's estimates and calculations indicate the following:

	Annualized Water Treatment Costs*	
Company Code	As a Percent of 1972 Operating Profit Before Taxes	As a Percent of 1972 Sales
AA	1.06%	nil
BB	0.6%	nil
CC	1.63%	nil
DD	nil	nil
EE	nil**	nil**
FF	7.17%	0.64%
GG	nil	nil
HH	nil	nil

*1972 dollars

** Less than 0.5%

Undoubtedly, Company FF's profits will be impacted by the BAT costs. However, the magnitude of cost involved represents only 0.64% of this company's sales -- on a no-growth, constant 1972 dollar basis. Thus, other things equal, company FF's impact would be lessened to the extent it could pass along a cost increase of this magnitude.

If these calculations are of the correct order of magnitude, it seems clear that the variation in the profitability of asbestos manufacturing caused by water treatment costs to meet the BAT standards will

be quite small in comparison with that from the other factors with which management must contend.

Capital Availability. Referring again to Table XXV, one may make a similar comment, in respect to capital investment requirements to meet the BAT standards, as was made above in respect to the impact of water treatment costs on profitability. That is, the requirement for capital funds appears small in dollar terms. Company FF has a relatively larger requirement, but one which is not regarded as necessarily outside of normal fluctuations in a company's capital expenditure program over a period of years. Accordingly, the considerations of cash flows and debt-to-equity ratios which would be important in assessing the companies' abilities to meet large scale new capital spending plans are not called for here. The picture is rather one in which the expenditures called for can probably be accommodated easily within the regular corporate planning and budgeting framework - although it cannot be suggested that they would be viewed in the same light as investments in new capacity. One might add that, as a result of favorable tax rulings, there has been a sharp increase in the use of tax-exempt pollution control revenue bond financing by industry in the last 12-18 months. The evidence suggests that an even greater utilization of this type of financing will occur in the future. This represents a new dimension in corporate finance and additional flexibility for management in meeting pollution abatement requirements.

c. Production Effects

It is instructive to repeat a prior hypothesis that an asbestos product manufacturing facility would be considered economically sensitive if its additional annual water treatment costs required to comply with the BAT standards exceed about 4.5% of annual sales of that product. Accordingly, the following discussion will consider each product line in accordance with the above criterion.

Asbestos-cement pipe (App. W). Only 2 of the 14 listed plants are already in compliance with the BAT standards. Of those requiring an upgrading of their treatment facilities, estimates of the involved costs show that the necessary expenditures in most cases amount to less than 1% of the annual sales. Thus, no production curtailment or cessation is anticipated in the asbestos-cement pipe segment as a result of implementation of the BAT effluent standards.

Asbestos-cement sheet (App. X). As with the BPT standards, only one sheet plant, SS-3, is susceptible to adverse economic impact from the BAT standards. On the basis of estimated 1972 statistics, the loss of this plant, if this should occur, would result in a production loss of only 4,000 tons (about 1% of total production), - an output which can be easily generated by other plants which are currently operating at less than full capacity.

Asbestos paper (App. Y). On the basis of the criterion set forth above, only one plant, ER-1, with annual sales of $0.3 million on an

output of 750 tons, may be regarded as potentially threatened by the BAT standards. The potential production loss would thus be equivalent to only 0.3% of the total estimated 1972 industry output of 230,000 per year. Obviously, this potential production deficit can be readily made up by the unimpacted plants.

Asbestos millboard (App.T). Since the BPT and BAT standards for this product are identical, the comments made under the BPT treatment effects are equally applicable here. Therefore, EM-1 and EM-3 may be considered as potential candidates for shutdown as a result of the BAT standards.

Asbestos roofing (App. Z). According to the pre-established criteria, no asbestos roofing plant is considered susceptible to impact from the BAT standards since the maximum annual cost incurred by an individual plant or product line is 3.2% of sales.

Asbestos floor tile (App. AA). For the tile plants surveyed, the maximum additional annual water treatment costs to comply with the BAT standards equals only 0.3% of annual sales. As such, all the tile facilities are regarded as relatively well insulated from any impact due to the promulgation of these standards.

In summary, solely on the basis of high water treatment costs in relation to estimated value of product sales, the following plants are possible candidates for shutdown as a result of the BAT effluent standards:

Plant Code	Product	Location	Annual Sales of Product (10^6)	Additional Annual Water Treatment Cost
SS-3	Sheet	Southern U.S.	1.0	$70,300
ER-1	Paper	Eastern U.S.	0.33	20,700
EM-1	Millboard	Eastern U.S.	0.77	38,000
EM-3	Millboard	Eastern U.S.	1.1	38,000

The aggregate 1972 sales of the products under study are estimated at about $550 million. Thus, the potential and apparent loss of sales due to cessation of the above production lines amounts to only 0.6%. Note that this loss does not necessarily mean a reduction in the absolute quantity of product generated by the industry as a whole. It is rather to be expected that installed capacity now only partially utilized at other plants will be geared-up to compensate for these apparent losses.

d. Employment Effects

In addition to the three plants previously identified as impact-sensitive with regard to the BPT standards, only one other facility, ER-1,

a paper plant located in an Eastern state, is considered threatened by reason of the BAT standards. The total number of jobs threatened by the possible closure of these plants is estimated at 285 -- equivalent to 2.4 percent of the industry total. Thus, it is concluded that the potential employment effect due to the BAT standards is negligible.

e. Community Effects

The comments made regarding the potential community effects arising out of the possible closure of SS-3, EM-1 and EM-3 as a result of implementation of the BPT standards are equally applicable here. A comment is warranted therefore only with regard to the potential community impact resulting from shutdown of ER-1.

This plant is located in a sparsely populated state contiguous to a major metropolis. The concentration of manufacturing industry in the immediate area has been dwindling over the last two decades. Nevertheless unemployment is below national average (3.0 to 4.9%). This suggests that in spite of the recent erosion of manufacturing activity, employees dislocated because of shut-down of ER-1 may be able to obtain alternative employment in other endeavors in the area.

f. Balance of Payment Effects

As discussed previously, the trade in asbestos products has generally been in favor of the United States, and it is expected that this pattern will continue, unaffected by the BPT and BAT standards. By 1983, however, one would look for the gap between the values of exports and imports to be narrower than they are currently. As the economies of the developing nations advance, the combination of a developed local manufacturing capability and a reduced growth rate in the construction field should dampen their demand for imported asbestos products.

4. Impact of New Source Performance Standards

a. Impact on Industry Growth

The asbestos products manufacturing industry experienced an impressive growth from its inception in the United States through the decade of the 1950's. That growth rate has since decreased to a current annual level of near 5 percent, and there are indications it may not exceed this level in the future. In combination with the fact that asbestos products manufacturing is a relatively low profit endeavor, it is doubtful whether large investments in new plants and capacities can be expected in the next decade or so, especially in light of the fact that in-place plants are currently operating at an average of near 70 percent of capacity. One must also take into consideration the recent rash of publicity regarding the alleged adverse environmental and health effects of asbestos, as well as the severe competition posed to asbestos products from man-made materials. Accordingly, it may be justified to conclude that the future growth rate in this industry would probably not exceed that of the general economy.

The additional costs of installing water treatment facilities required to meet the proposed new source standards can only serve to inhibit the wide-spread installation of new plants for the manufacture of those asbestos products which are generally regarded to be low profit items.

While no hard and fast conclusions may be drawn without specific financial analysis of a given proposed plant, it is instructive to consider semi-quantitatively the potential impact of the additional water treatment capital costs on the investment required by a new manufacturing facility. As an illustration, consider an asbestos-cement pipe facility with an annual production capacity of 150,000 tons. The necessary capital investment (exclusive of working capital and water treatment capital costs) is estimated at about $3 million. If the investment in water treatment facilities required to comply with the BAT standards is assumed to be identical to those of a typical pipe plant (Table XXI) and equivalent to $305,000, it can be deduced that these added expenditures amount to an additional 10 percent of the original plant cost. The specific effects of these additional investments on the corporate decision to enter into or stay out of such a new venture can only be determined after analyzing all the financial data applicable to the contemplated installation. In the absence of such specific data, it is only safe to observe that an additional 10 percent capital requirement is often large enough to kill a new manufacturing venture.

Thus, the above factors tend to indicate that, whereas even without the proposed water treatment costs no dramatic increases in installed capacity are thought to be forthcoming for the balance of this decade, the imposition of these added costs can only produce a reinforcing effect, thus worsening the situation.

b. Impact on Prices

In a previous section, it was indicated that the price of asbestos products has, over the last five to ten years, remained reasonably stable or increased at a rate lower than that of the general manufactured product price index. This may be the result of increased manufacturing efficiency and productivity and the threat of market penetration represented by competitive substitute materials. All indications are that any future price increases will be moderate and at worst will aim to recoup increased manufacturing costs where these cannot be comfortably absorbed. The incremental costs of meeting the BPT and BAT standards are very negligible, and even if these costs were to be passed-on, would not, in themselves, inhibit demand, result in significant substitution of alternative materials, or accelerate the rate of import penetration of the domestic market.

c. Impact on Plant Location

In view of the very modest incremental costs incurred by the asbestos products manufacturing industry in meeting the BPT and BAT effluent

standards, it is not anticipated that any relocation to foreign sites, of any of the currently operating plants would occur; nor is it visualized that these water treatment costs are a sufficiently attractive incentive for locating a new facility in a foreign country in preference to the United States. It is increasingly apparent that many foreign countries are beginning to institute environmental quality standards whose long-term effect would be to erase the manufacturing cost advantage hitherto enjoyed by foreign manufacturers. Thus, the attraction of these countries as a haven from pollution regulation is fast disappearing.

While recognizing the virtually insignificant effect of new water pollution control costs with respect to new plant location, it must be observed that domestic asbestos products manufacturers have had to contend with, among other non-productive costs, the expenses due to air quality and occupational safety and health standards, which several foreign countries do not now require. These factors, rather than incremental water pollution costs, per se, may be among the significant inducements to prefering a foreign plant site. It is understood that this situation already exists with respect to the asbestos textiles manufacturing industry.

d. Balance of Payments Effects

As discussed previously, the United States has traditionally enjoyed a favorable balance of trade relative to manufactured asbestos products. While the export-versus-import gap is expected to narrow, it should continue in favor of the United States for the balance of this decade. And since the costs of meeting the BPT and BAT standards do not, by themselves, represent a significant incentive for foreign manufacturing of asbestos products (by U.S. firms), it is reasoned that these modest additional costs, per se, will not significantly alter the balance of payments picture.

LIMITS OF THE ANALYSIS

This assessment of the potential economic impact of the BPT and BAT effluent guidelines on the asbestos manufacturing industry has been conducted on the assumption that the unit operations and corresponding typical plant capital investment and annual treatment costs suggested by the Guidelines Development Document are truly applicable to the effluents generated by the appropriate industry categories. As such, the economic impact conclusions rest on the accuracy of these cost data and treatment schemes.

The evaluation of the economic impact of additional water treatment costs, and particularly the determination of specific plant costs as a proportion of annual sales, is a function of at least three estimated quantities, -- "annualized" water treatment costs, typical annual production rates, and representative unit sales values of products. Thus, any gross errors in any of these quantities affects the accuracy of the

impact parameter. To minimize such errors, careful judgment has been exercised in the estimates and they are believed to be reasonably reflective of actual experience. A potentially complicating consideration is the fact that treatment and capital costs were developed in terms of 1971 dollars, whereas the financial impact for the major companies is experienced in terms of current dollars. Accordingly, differing rates of inflation and cost escalation will influence the impact parameter.

It needs to be indicated that while the present analysis has identified plants that are potentially vulnerable as a result of the effluent guidelines, the decision to curtail or discontinue operations at a given plant is governed by a number of interracting factors; and while water treatment costs may appear unacceptably high at a threatened plant, the decision to continue or terminate operations is a function of corporate goals, present and future market conditions, etc.

Finally, the interpretation of the potential impact of the proposed effluent guidelines has not taken into account the concurrent and reinforcing effects of other legislations and governmental controls which, with the additional water control costs, may create a "last-straw" effect, even though the effluent treatment costs may by themselves be negligible. Specifically, the effects of these guidelines must, in a subsequent study, be evaluated along with those of such other control regulations as OSHA and air quality standards.

APPENDICES

APPENDIX A

EFFLUENT LIMITATIONS GUIDELINES FOR THE ASBESTOS MANUFACTURING POINT SOURCE CATEGORY

PRODUCT CATEGORY	EFFLUENT CHARACTERISTIC	EFFLUENT LIMITATIONS (Metric units, kg/kkg of product)					
		BPT* Standards		BAT* Standards		NSP* Standards	
		Maximum for any one day	Average of daily values**	Maximum for any one day	Average of daily values**	Maximum for any one day	Average of daily values**
Asbestos-cement pipe	TSS#	0.57	0.19	No discharge of process waste water pollutants		0.57	0.19
	pH	Within the range 6.0 to 9.0				Within the range 6.0 to 9.0	
Asbestos-cement sheet	TSS	0.68	0.23	No discharge of process waste water pollutants		No discharge of process waste water pollutants	
	pH	Within the range 6.0 to 9.0					
Asbestos paper (starch binder)	TSS	0.55	0.35	No discharge of process waste water pollutants		No discharge of process waste water pollutants	
	pH	Within the range 6.0 to 9.0					
Asbestos paper (elastomeric binder)	TSS	0.55	0.35	No discharge of process waste water pollutants		0.55	0.35
	pH	Within the range 6.0 to 9.0				Within the range 6.0 to 9.0	
Asbestos millboard	TSS	No discharge of process waste water pollutants		No discharge of process waste water pollutants		No discharge of process waste water pollutants	
	pH						
Asbestos roofing	COD##	0.015	0.008	No discharge of process waste water pollutants		No discharge of process waste water pollutants	
	TSS	0.010	0.006				
	pH	Within the range 6.0 to 9.0					
Asbestos floor tile	COD	0.14	0.09	No discharge of process waste water pollutants		No discharge of process waste water pollutants	
	TSS	0.06	0.04				
	pH	Within the range 6.0 to 9.0					

* { BPT = Best practicable control technology currently available
BAT = Best available technology economically achievable
NSP = Standard of performance for new sources

** Average of daily values for 30 consecutive days shall not exceed this value

Total suspended solids

Chemical oxygen demand

Arthur D Little Inc

APPENDIX B

PRESENT PATTERN OF EFFLUENT TREATMENT BY ASBESTOS PRODUCTS MANUFACTURING PLANTS

Product Category	Plant Code	Effluent Flow Rate (10^3 GPD)		Present Treatment
		Raw	Treated	
Asbestos-cement pipe	EP-1	-	-	C
	EP-2	555	45	C
	MP-1	1,740	0	D
	MP-2	-	270	A
	MP-3	485	485	C
	SP-1	-	200	C
	SP-2	-	190	B
	SP-3	-	-	B
	SP-4	-	20	B
	SP-5	-	540	B
	WP-1	-	-	A
	WP-2	-	80	B
	WP-3	-	480	B
	WP-4	-	-	D
Asbestos-cement sheet	ES-1	-	150	A
	ES-2	-	540	B
	ES-3	-	-	C
	ES-4	-	70	A
	ES-5	-	-	B
	MS-1	240	0	D
	MS-2	-	160	B
	MS-3	170	0	D
	SS-1	-	45	B
	SS-2	-	40	B
	SS-3	-	70	A
	SS-4	-	-	A
	WS-1	-	-	A
Asbestos paper	ER-1	-	270	B
	ER-2	720	0	C
	ER-3	-	-	B
	ER-4	-	1,000	B
	ER-5	-	1,100	A
	ER-6	-	1,300	B
	ER-7	-	0	C

Product Category	Plant Code	Effluent Flow Rate (10^3 GPD)		Present Treatment
		Raw	Treated	
	MR-1	450	0	C
	MR-2	-	-	A
	SR-1	-	540	B
	WR-1	-	540	B
Asbestos millboard	EM-1	-	-	A
	EM-2	-	-	B
	EM-3	-	-	A
	EM-4	-	-	B
	EM-5	-	-	B
	MM-1	180	0	C
	MM-2	350	0	C
Asbestos roofing	EF-1	-	170	B
	EF-2	-	-	A
	EF-3	-	-	B
	EF-4	-	-	A
	MF-1	370	0	C
	SF-1	-	43	B
	SF-2	-	7	A
	SF-3	-	-	A
	WF-1	-	-	A
Asbestos floor tile	ET-1	0	60	A
	ET-2	-	213	B
	ET-3	-	-	A
	MT-1	-	430	B
	MT-2	-	-	A
	MT-3	-	-	A
	ST-1	-	-	A
	ST-2	-	68	A
	ST-3	-	-	A
	WT-1	-	4	B
	WT-2	-	-	A
	WT-3	-	-	A
	WT-4	-	7	A

APPENDIX C

REPRESENTATIVE MANUFACTURING PLANTS USED IN DEVELOPING COST INFORMATION

Product Category	Estimated Daily Production	Wastewater Flow	
		Actual	Design*
	Tons	MGD	MGD
Asbestos-cement pipe	160	0.56	0.50
Asbestos-cement sheet	120	0.17	0.125
Asbestos paper	70	0.72	0.50
Asbestos millboard	15	0.18	0.10
Asbestos roofing	720	0.37	0.40
Asbestos floor tile	700,000 pc	0.43	0.40

Source: Effluent Guidelines Development Document

*Design flow used in developing cost estimates.

APPENDIX D

ASBESTOS–CEMENT SHEET PRODUCTS: WATER TREATMENT CAPITAL INVESTMENT AS A FUNCTION OF TREATMENT CAPACITY

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) BPT Standards	To Satisfy BAT Standards
75	68,000	111,000
125*	92,000	151,000
200	122,000	200,000
500	211,000	347,000
750	270,000	442,000

*Typical Plant Capacity.

Source: Based on "typical plant" cost contained in the Effluent Guidelines Development Document.

APPENDIX E

ASBESTOS PAPER PLANTS: WATER TREATMENT CAPITAL INVESTMENT AS A FUNCTION OF TREATMENT CAPACITY

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) To Satisfy BPT Standards	BAT Standards
100	90,000	112,000
250	156,000	194,000
500*	237,000	294,000
1,000	359,000	446,000
1,500	458,000	568,000

*Typical Plant Capacity.

Source: Based on "typical plant" cost contained in the Effluent Guidelines Development Document.

APPENDIX F

ASBESTOS MILLBOARD PLANT: WATER TREATMENT CAPITAL INVESTMENT AS A FUNCTION OF TREATMENT CAPACITY

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) To Satisfy BPT and BAT Standards
50	34,000
100*	52,000
250	90,000
500	137,000
750	174,000

*Typical Plant Capacity

Source: Based on "typical plant" cost contained in the Effluent Guidelines Development Document.

APPENDIX G

ASBESTOS ROOFING PLANT: WATER TREATMENT CAPITAL INVESTMENT AS A FUNCTION OF TREATMENT CAPACITY

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) BPT Standards	To Satisfy BAT Standards
25	5,000	9,000
100	11,000	21,000
250	18,000	36,000
400*	24,000	48,000
750	35,000	70,000

*Typical Plant Capacity

Source: Based on "typical plant" cost contained in the Effluent Guidelines Development Document.

APPENDIX H

ASBESTOS FLOOR TILE PLANT: WATER TREATMENT CAPITAL INVESTMENT AS A FUNCTION OF TREATMENT CAPACITY

Effluent Treatment Capacity (10^3 Gals/Day)	Capital Investment ($) BPT Standards	To Satisfy BAT Standards
25	10,000	21,000
100	23,000	48,000
250	39,000	83,000
400*	52,000	110,000
750	76,000	160,000

*Typical Plant Capacity.

Source: Based on "typical plant" cost contained in the Effluent Guidelines Development Document.

APPENDIX I

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS-CEMENT PIPE PLANTS

I. BPT Standards					
Capital Cost	6,100	10,600	16,100	24,400	31,100
Depreciation	3,800	6,600	10,100	15,300	19,430
Operation & Maintenance	17,560	43,900	87,800	175,600	263,400
Energy & Power	1,400	3,500	7,000	14,000	21,000
Total Annual Cost	28,860	64,600	121,000	229,300	334,930
Cost per 1000 gallons	0.79	0.71	0.66	0.63	0.61

II. BAT Standards					
Capital Cost	9,300	16,100	24,400	37,000	47,200
Depreciation	5,800	10,100	15,300	23,100	29,500
Operation & Maintenance	22,830	49,200	98,300	196,600	294,900
Energy & Power	2,400	6,000	11,900	23,800	35,700
Total Annual Cost	40,330	81,400	149,900	280,500	406,900
Cost per 1000 gallons	1.11	0.89	0.82	0.77	0.74

APPENDIX J

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS-CEMENT SHEET PLANTS

I. BPT Standards

Capital Cost	5,400	7,400	9,800	16,900	21,600
Depreciation	3,400	4,600	6,100	10,600	13,500
Operation & Maintenance	32,000	53,300	85,300	213,200	319,800
Energy & Power	2,500	4,200	6,700	16,800	25,200
Total Annual Cost	43,300	69,500	107,900	257,500	380,100
Cost per 1000 gallons	1.58	1.52	1.48	1.41	1.39

II. BAT Standards

Capital Cost	8,900	12,100	16,000	27,800	35,400
Depreciation	5,600	7,600	10,000	17,400	22,100
Operation & Maintenance	55,400	92,400	147,800	369,600	554,400
Energy & Power	4,200	7,000	11,200	28,000	42,000
Total Annual Cost	74,100	119,100	185,000	442,800	653,900
Cost per 1000 gallons	2.71	2.61	2.53	2.43	2.39

APPENDIX K

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS PAPER PLANTS

I. BPT Standards

Cost Item	Annual Water Treatment Costs ($)				
Capacity (10^3 Gals/Day)	100	250	500*	1,000	1,500
Capital Cost	7,200	12,510	18,960	28,740	36,650
Depreciation	4,510	7,820	11,850	17,960	22,910
Operation & Maintenance	3,200	8,000	16,000	32,000	48,000
Energy & Power	3,200	8,000	16,000	32,000	48,000
Total Annual Cost	18,130	36,330	62,810	110,700	155,560
Cost per 1000 gallons	0.50	0.40	0.34	0.30	0.28

II. BAT Standards

Capital Cost	8,960	15,520	23,520	35,650	45,480
Depreciation	5,600	9,700	14,700	22,280	28,420
Operation & Maintenance	8,800	22,000	44,000	88,000	132,000
Energy & Power	3,200	8,000	16,000	32,000	48,000
Total Annual Cost	26,560	55,220	98,220	177,930	253,900
Cost per 1000 gallons	0.73	0.61	0.54	0.49	0.46

APPENDIX L

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS MILLBOARD PLANTS

BPT & BAT Standards

Capital Cost	2,745	4,160	7,210	10,930	13,940
Depreciation	1,720	2,600	4,505	6,830	8,710
Operation & Maintenance	12,150	24,300	60,750	121,500	182,250
Energy & Power	3,500	7,000	17,500	35,000	52,500
Total Annual Cost	20,115	38,060	89,965	174,260	257,400
Cost per 1000 gallons	1.10	1.04	0.99	0.96	0.94

APPENDIX M

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS ROOFING PLANTS

I. BPT Standards

Cost Item	Annual Water Treatment Costs ($)				
Capacity (10^3 Gals/Day)	25	100	250	400*	750
Capital Cost	364	836	1,450	1,920	2,800
Depreciation	228	523	905	1,200	1,750
Operation & Maintenance	375	1,500	3,750	6,000	11,250
Energy & Power	81	325	813	1,300	2,440
Total Annual Cost	1,048	3,184	6,918	10,420	18,240
Cost per 1000 gallons	0.12	0.09	0.08	0.07	0.07

II. BAT Standards

Capital Cost	727	1,672	2,896	3,840	5,600
Depreciation	455	1,045	1,810	2,400	3,500
Operation & Maintenance	0	0	0	0	0
Energy & Power	525	2,100	5,250	8,400	15,750
Total Annual Cost	1,707	4,817	9,956	14,640	24,850
Cost per 1000 gallons	0.19	0.13	0.11	0.10	0.09

*Typical Plant Capacity

APPENDIX N

ANNUAL WATER TREATMENT COSTS FOR ASBESTOS FLOOR TILE PLANTS

I. BPT Standards

Cost Item	Annual Water Treatment Costs ($)				
Capacity (10^3 Gals/Day)	25	100	250	400*	750
Capital Cost	788	1,812	3,138	4,160	6,064
Depreciation	493	1,133	1,960	2,600	3,790
Operation & Maintenance	688	2,750	6,875	11,000	20,625
Energy & Power	113	450	1,125	1,800	3,375
Total Annual Cost	2,082	6,145	13,098	19,560	33,854
Cost per 1000 gallons	0.23	0.17	0.14	0.13	0.12

II. BAT Standards

Capital Cost	1,668	3,830	5,544	8,405	10,720
Depreciation	1,043	2,394	3,465	5,253	6,700
Operation & Maintenance	675	2,700	6,750	10,800	20,250
Energy & Power	188	750	1,875	3,000	5,625
Total Annual Cost	3,574	9,674	17,634	27,458	43,295
Cost per 1000 gallons	0.39	0.27	0.19	0.18	0.16

*Typical Plant Capacity

APPENDIX O

THE ASBESTOS PRODUCTS INDUSTRY: WATER TREATMENT COSTS TO MEET THE BPT STANDARDS

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos-cement Pipe	EP-1	0	0
	EP-2	0	0
	MP-1	0	0
	MP-2	140,000	69,500
	MP-3	0	0
	SP-1	0	0
	SP-2	45,000	15,300
	SP-3	76,000	32,900
	SP-4	20,000	1,800
	SP-5	80,000	43,400
	WP-1	200,000	120,500
	WP-2	30,000	7,300
	WP-3	75,000	36,800
	WP-4	0	0
	Subtotal	666,000	327,500
Asbestos-cement Sheet	ES-1	104,000	82,100
	ES-2	86,000	67,000
	ES-3	0	0
	ES-4	65,000	40,900
	ES-5	36,000	17,800
	MS-1	0	0
	MS-2	43,000	23,400
	MS-3	0	0
	SS-1	20,000	7,400
	SS-2	19,000	6,600
	SS-3	65,000	40,900
	SS-4	92,000	69,400
	WS-1	92,000	69,400
	Subtotal	622,000	424,900

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos Paper	ER-1	0	0
	ER-2	0	0
	ER-3	0	0
	ER-4	0	0
	ER-5	380,000	118,500
	ER-6	0	0
	ER-7	0	0
	MR-1	0	0
	MR-2	237,000	62,100
	MR-3	0	0
	SR-1	0	0
	WR-1	0	0
	Subtotal	617,000	180,600
Asbestos Millboard	EM-1	52,000	38,000
	EM-2	12,000	3,300
	EM-3	52,000	38,000
	EM-4	12,000	3,300
	EM-5	12,000	3,300
	MM-1	0	0
	MM-2	0	0
	Subtotal	140,000	85,900
Asbestos Roofing	EF-1	0	0
	EF-2	24,000	10,400
	EF-3	0	0
	EF-4	24,000	10,400
	MF-1	0	0
	SF-1	0	0
	SF-2	2,000	3,000
	SF-3	24,000	10,400
	WF-1	24,000	10,400
	Subtotal	98,000	44,600

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos Floor Tile	ET-1	16,000	4,400
	ET-2	0	0
	ET-3	52,000	19,600
	MT-1	0	0
	MT-2	52,000	19,600
	MT-3	52,000	19,600
	ST-1	52,000	19,600
	ST-2	18,000	5,000
	ST-3	52,000	19,600
	WT-1	0	0
	WT-2	52,000	19,600
	WT-3	52,000	19,600
	WT-4	6,000	500
	Subtotal	404,000	147,100

APPENDIX P

THE ASBESTOS PRODUCTS INDUSTRY: WATER TREATMENT COSTS TO MEET THE BAT STANDARDS

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos-cement Pipe	EP-1	104,000	28,900
	EP-2	35,000	5,300
	MP-1	0	0
	MP-2	210,000	86,700
	MP-3	105,000	28,300
	SP-1	60,000	16,800
	SP-2	100,000	32,600
	SP-3	181,000	67,200
	SP-4	50,000	3,800
	SP-5	190,000	71,000
	WP-1	305,000	149,900
	WP-2	65,000	16,400
	WP-3	180,000	66,600
	WP-4	0	0
	Subtotal	1,585,000	573,500
Asbestos-cement Sheet	ES-1	170,000	141,300
	ES-2	225,000	268,100
	ES-3	59,000	49,600
	ES-4	105,000	70,300
	ES-5	95,000	67,600
	MS-1	0	0
	MS-2	110,000	84,700
	MS-3	0	0
	SS-1	60,000	24,600
	SS-2	56,000	22,200
	SS-3	109,000	70,300
	SS-4	151,000	119,100
	WS-1	151,000	119,100
	Subtotal	1,291,000	1,036,900

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos Paper	ER-1	38,000	20,700
	ER-2	0	0
	ER-3	57,000	35,400
	ER-4	86,000	67,200
	ER-5	470,000	194,700
	ER-6	100,000	85,400
	ER-7	0	0
	MR-1	0	0
	MR-2	294,000	98,200
	MR-3	25,000	87,800
	SR-1	60,000	39,400
	WR-1	60,000	39,400
	Subtotal	1,190,000	582,800
Asbestos Millboard	EM-1	52,000	38,000
	EM-2	12,000	3,300
	EM-3	52,000	38,000
	EM-4	12,000	3,300
	EM-5	12,000	3,300
	MM-1	0	0
	MM-2	0	0
	Subtotal	140,000	85,900
Asbestos Roofing	EF-1	14,000	2,200
	EF-2	48,000	14,600
	EF-3	24,000	4,200
	EF-4	48,000	14,600
	MF-1	0	0
	SF-1	6,000	900
	SF-2	7,000	200
	SF-3	48,000	14,600
	WF-1	48,000	14,600
	Subtotal	243,000	65,900

Product Category	Plant Code	Estimated Costs ($)	
		Capital Investment	Annual Cost
Asbestos Floor Tile	ET-1	33,000	7,300
	ET-2	33,000	4,700
	ET-3	110,000	27,500
	MT-1	52,000	7,900
	MT-2	110,000	27,500
	MT-3	110,000	27,500
	ST-1	110,000	27,500
	ST-2	37,000	7,900
	ST-3	110,000	27,500
	WT-1	5,000	200
	WT-2	110,000	27,500
	WT-3	110,000	27,500
	WT-4	11,000	1,100
	Subtotal	1,051,000	214,300

APPENDIX Q

ASBESTOS-CEMENT PIPE MANUFACTURING INDUSTRY – ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BPT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales (10^6)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
EP-1	83,000	16.6	0	0
EP-2	40,000	8.0	0	0
MP-1	67,500	13.5	0	0
MP-2	66,000	13.2	69,500	0.53
MP-3	72,250	14.45	0	0
SP-1	31,250	6.25	0	0
SP-2	30,500*	6.1	15,300	0.25
SP-3	60,000*	12.0	32,900	0.27
SP-4	46,250	9.25	1,800	0.02
SP-5	58,000	11.6	43,400	0.37
WP-1	50,000*	10.0	120,500	1.3
WP-2	37,500	7.5	7,300	0.10
WP-3	87,500	17.5	36,800	0.21
WP-4	50,000	10.0	0	0
Total	779,750	155.95	327,500	0.21

Basis: 250 days/year operation; sales price of $0.10 per pound.

*Contractor's Estimates

APPENDIX R

ASBESTOS-CEMENT SHEET MANUFACTURING INDUSTRY -- ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BPT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales ($\$10^6$)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
ES-1	25,000	6.25	82,100	1.3
ES-2	31,250	7.81	67,000	0.86
ES-3	30,000*	7.5	0	0
ES-4	30,000	7.5	40,900	0.55
ES-5	25,000*	6.25	17,800	0.28
MS-1	25,000	6.25	0	0
MS-2	65,000	16.25	23,400	0.14
MS-3	30,000	7.5	0	0
SS-1	30,000*	7.5	7,400	0.10
SS-2	50,000	12.5	6,600	0.05
SS-3	4,000	1.0	40,900	4.09
SS-4	25,000*	6.25	69,400	1.1
WS-1	30,000*	7.5	69,400	0.93
Total	400,250	100.06	424,900	0.43

Basis: 250 days/year operation; $0.125 per pound sales price.

*Contractor's Estimates

APPENDIX S

ASBESTOS PAPER MANUFACTURING INDUSTRY -- ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BPT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales (10^6)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
ER-1	750	0.33	0	0
ER-2	17,500	7.7	0	0
ER-3	25,000*	11.0	0	0
ER-4	12,500*	5.5	0	0
ER-5	18,750*	8.25	118,500	1.44
ER-6	28,600	12.58	0	0
ER-7	24,000	10.56	0	0
MR-1	20,000	8.8	0	0
MR-2	18,750*	8.25	62,100	0.75
MR-3	14,250	6.27	0	0
SR-1	25,000*	11.0	0	0
WR-1	25,000*	11.0	0	0
Total	230,100	101.24	180,600	0.18

Basis: 250 days/year operation; sales price of $0.22 per pound.

*Contractor's Estimates

APPENDIX U

ASBESTOS ROOFING MANUFACTURING INDUSTRY – ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BPT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales ($\$10^6$)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
EF-1	2,140	0.482	0	0
EF-2	2,000*	0.45	10,400	2.3
EF-3	2,500*	0.56	0	0
EF-4	2,000*	0.45	10,400	2.3
MF-1	3,600	0.81	0	0
SF-1	2,500	0.56	0	0
SF-2	3,600*	0.81	3,000	0.4
SF-3	3,600*	0.81	10,400	1.3
WF-1	3,600*	0.81	10,400	1.3
Total	25,540	5.742	44,600	0.8

Basis: 250 days/year operation; average sale price of $225 per ton.

*Contractor's Estimates

APPENDIX V

ASBESTOS FLOOR TILE MANUFACTURING INDUSTRY – ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BPT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales (10^6)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
ET-1	135.0	17.55	4,400	0.03
ET-2	125.0	16.25	0	0
ET-3	162.5*	21.125	19,600	0.09
MT-1	175.0	22.75	0	0
MT-2	73.25	9.52	19,600	0.21
MT-3	125.0*	16.25	19,600	0.12
ST-1	75.0*	9.75	19,600	0.20
ST-2	85.0	11.05	5,000	0.05
ST-3	137.5	17.88	19,600	0.11
WT-1	33.75	4.39	0	0
WT-2	137.5*	17.88	19,600	0.11
WT-3	62.5*	8.13	19,600	0.24
WT-4	78.75	10.24	500	0.00
Total	1,405.75	182.765	147,100	0.08

Basis: 250 days/year operation; average sales price of $0.13 per piece.

*Contractor's Estimates

APPENDIX W

ASBESTOS-CEMENT PIPE MANUFACTURING INDUSTRY ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BAT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (tons)	Estimated Annual Sales (10^6)	Annual Water Treatment Costs ($)	Water Treatment Cost As Percent of Sales
EP-1	83,000	16.6	28,900	0.17
EP-2	40,000	8.0	5,300	0.07
MP-1	67,500	13.5	0	0
MP-2	66,000	13.2	86,700	0.66
MP-3	72,250	14.45	28,300	0.20
SP-1	31,250	6.25	16,800	0.27
SP-2	30,500*	6.1	32,600	0.53
SP-3	60,000*	12.0	67,200	0.56
SP-4	46,250	9.25	3,800	0.04
SP-5	58,000	11.6	71,000	0.61
WP-1	50,000*	10.0	149,900	1.50
WP-2	37,500	7.5	16,400	0.22
WP-3	87,500	17.5	66,600	0.38
WP-4	50,000*	10.0	0	0
Total	779,750	155.95	573,500	0.37

Basis: 250 days/year operation; sales price of $0.10 per pound.

*Contractor's Estimates

APPENDIX X

ASBESTOS-CEMENT SHEET MANUFACTURING INDUSTRY ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BAT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (tons)	Estimated Annual Sales ($10^6)	Annual Water Treatment Costs ($)	Water Treatment Cost As Percent of Sales
ES-1	25,000	6.25	141,300	2.3
ES-2	31,250	7.81	268,100	3.4
ES-3	30,000*	7.5	49,600	0.7
ES-4	30,000	7.5	70,300	0.9
ES-5	25,000*	6.25	67,600	1.1
MS-1	25,000	6.25	0	0
MS-2	65,000	16.25	84,700	0.5
MS-3	30,000	7.5	0	0
SS-1	30,000*	7.5	24,600	0.3
SS-2	50,000	12.5	22,200	0.2
SS-3	4,000	1.0	70,300	7.0
SS-4	25,000*	6.25	119,100	1.9
WS-1	30,000*	7.5	119,100	1.6
Total	400,250	100.06	1,036,900	1.0

Basis: 250 days/year operation; $0.125 per pound sales price.

*Contractor's Estimates

APPENDIX Y

ASBESTOS PAPER MANUFACTURING INDUSTRY WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BAT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales (10^6)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
ER-1	750	0.33	20,700	6.3
ER-2	17,500	7.7	0	0
ER-3	25,000*	11.0	35,400	0.3
ER-4	12,500*	5.5	67,200	1.2
ER-5	18,750*	8.25	194,700	2.4
ER-6	28,600	12.58	85,400	0.7
ER-7	24,000	10.56	0	0
MR-1	20,000	8.8	0	0
MR-2	18,750*	8.25	98,200	1.2
MR-3	14,250	6.27	87,800	1.4
SR-1	25,000*	11.0	39,400	0.4
WR-1	25,000*	11.0	39,400	0.4
Total	230,100	101.24	582,800	0.6

Basis: 250 days/year operation; sales price of $0.22 per pound.

*Contractor's Estimates

APPENDIX Z

ASBESTOS ROOFING MANUFACTURING INDUSTRY ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BAT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (Tons)	Estimated Annual Sales ($\$10^6$)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
EF-1	2,140	0.482	2,200	0.5
EF-2	2,000	0.45	14,600	3.2
EF-3	2,500*	0.56	4,200	0.8
EF-4	2,000*	0.45	14,600	3.2
MF-1	3,600	0.81	0	0
SF-1	2,500	0.56	900	0.2
SF-2	3,600*	0.81	200	0.0
SF-3	3,600*	0.81	14,600	1.8
WF-1	3,600*	0.81	14,600	1.8
Total	25,540	5.742	65,900	1.14

Basis: 250 days/year operation; average sales price of $225 per ton.

*Contractor's Estimates

APPENDIX AA

ASBESTOS FLOOR TILE MANUFACTURING INDUSTRY ANNUAL WATER TREATMENT COSTS (BY PLANTS) TO SATISFY THE BAT EFFLUENT STANDARDS

Plant Code	Estimated Annual Production (10^6 pcs.)	Estimated Annual Sales (10^6)	Annual Water Treatment Cost ($)	Water Treatment Cost As Percent of Sales
ET-1	135.0	17.55	7,300	0.04
ET-2	125.0	16.25	4,700	0.03
ET-3	162.5*	21.125	27,500	0.13
MT-1	125.0	22.75	7,900	0.03
MT-2	73.25	9.52	27,500	0.29
MT-3	125.0*	16.25	27,500	0.17
ST-1	75.0	9.75	27,500	0.28
ST-2	85.0	11.05	7,900	0.07
ST-3	137.5*	17.88	27,500	0.15
WT-1	33.75	4.39	200	0.00
WT-2	137.5*	17.88	27,500	0.15
WT-3	62.5*	8.13	27,500	0.34
WT-4	78.75	10.24	1,100	0.01
Total	1,405.75	182.765	214,300	0.11

Basis: 250 days/year operation; average sales price of $0.13 per piece.

*Contractor's Estimates